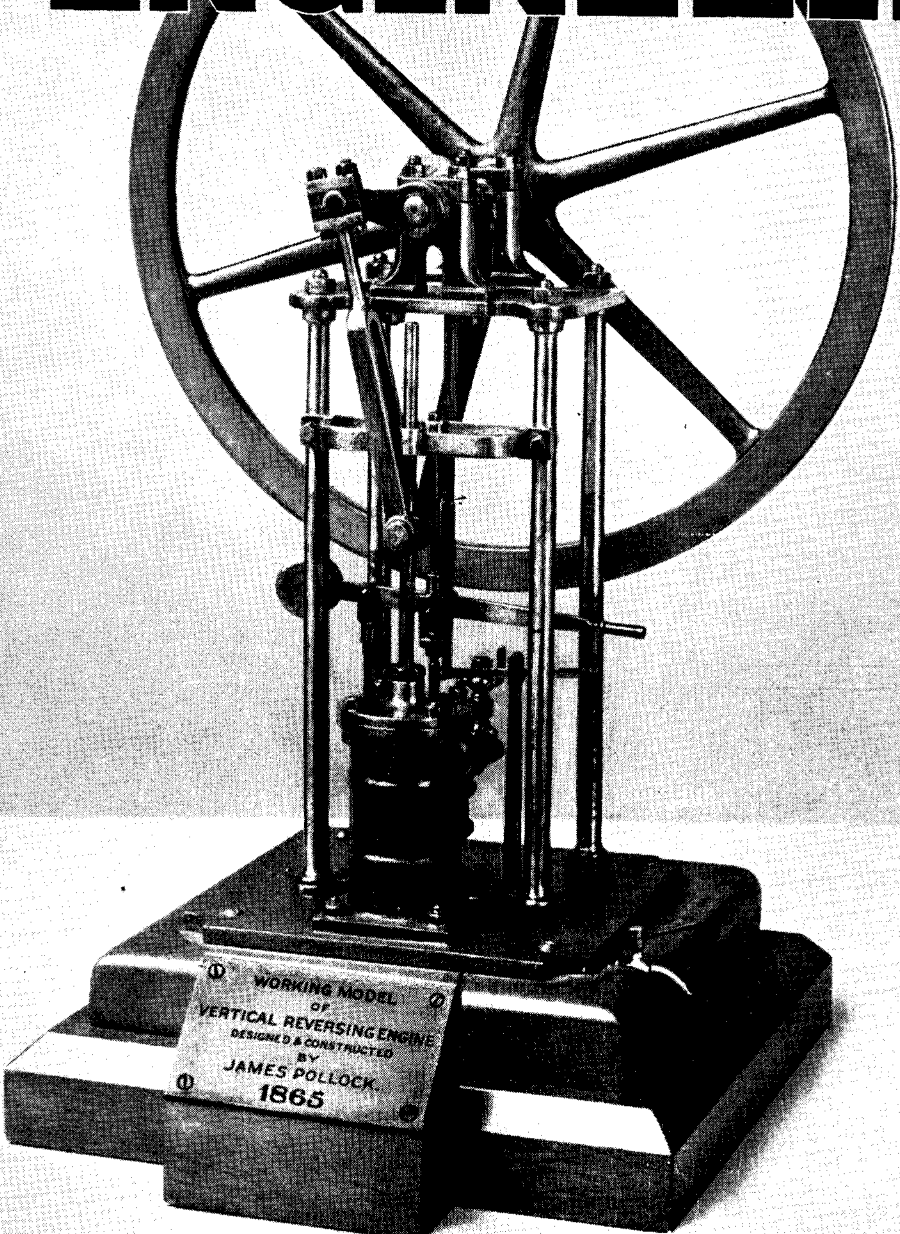
THE MODEL ENGINEER



Vol. 96 No. 2400 THURSDAY MAY 22 1947 9d.

The MODEL ENGINEER

Percival Marshall & Co. Ltd., 23, Great Queen St., London, W.C.2

22 MAY 1947 VOL. 96. NO. 2400

Smoke Rings 619
Sheffield's Fourth Exhibition .. 621
Aeolian Harps 624
"Blackhorn Handles" 625
A Hacksaw Machine 626
A Gas-Turbine Loco. for the G.W.R. 629
Electrical Specialities 630
The "Ideal Lathe" Competition .. 631
Farewell to "Utility" 634
Boiler Feed-Pump for "Juliet" .. 637
A Tandem Compound Engine .. 641
Club Announcements 645

SMOKE RINGS

Our Cover Picture

WE are indebted to Mr. Walter Pollock, of the shipbuilding firm of James Pollock, Sons & Co. Ltd., for the photograph reproduced on the cover, of a vertical single-cylinder steam engine, made by his father, Mr. James Pollock, in 1865. The engine was his father's design and own handicraft throughout; even the small nuts were cut from a solid piece of plate. It has been preserved as a show-piece in the firm's London office for the last 50 years, and even today is in full working order. It is a very neat and attractive design, representing a type of engine much in use for the driving of small workshops at that period.

Looking Ahead

IN publishing this week a description of the Gas-Turbine Locomotive, now being built by Metropolitan-Vickers Limited, for the Great Western Railway, I would draw the attention of my readers to the striking progress in the development of gas-turbines and reaction engines now taking place in this country. Already the displacement of reciprocating engines by gas-turbines for the larger types of aircraft is an accepted fact, and we now learn that Sir Malcolm Campbell is planning to attack his own water speed record of 141.7 miles an hour in a further edition of the famous "Bluebird" craft, the hull of which is under construction by Messrs. Vospers Limited. A De Havilland "Goblin" engine, which will develop three thousand horse-power, is to be installed in this craft and, as the previous record was made with a "Rolls Royce" engine of the reciprocating piston type, developing one thousand nine hundred horse-power, there is every reason to believe that the speed of the present record will be exceeded by a substantial margin. Eye witnesses state that, recently, when the Goblin engine was undergoing tests at the Hatfield Works of the De Havilland Company, large logs of wood, caught in the exhaust jet, were sent spinning in the air, some distance away. The skill and ingenuity of model engineers has rarely failed to achieve, in miniature, what commercial engineering has achieved in full scale, and, although we understand that difficulties in connection with heat dissipation and the construction of suitable fuel pumps have so far prevented the scaling down of gas-turbines as a commercial proposition, we are convinced that model engineers will eventually find ways and means of overcoming these difficulties, and the first model gas-turbine will ere long see the light of day. It would seem fairly certain that the difficulty of fuel pumps will be overcome by something in the nature of an air pressure bottle, and the ingenuity of model engineers in producing a compression ignition engine without the normal fuel injection pump, is an example where model engineering has led in a field of development that may well be of value to full scale commercial engineering. Already we hear rumours of the Boffins of the model engineering cult, in their back room workshops, measuring the static thrust of their blow lamps scheming designs for miniature gas-turbines and reaction engines. How long it will be before practical developments bear fruit, none can tell, but we are sure that the

subject will be of great interest to our readers. Accordingly, we invite those who have an interest in this subject, whether practical or theoretical, to write to us, giving their views. Of particular interest would be accounts of experiments, successful or otherwise, by readers who have already made a beginning, for only by studying the failures of others, and learning of their successes, can the inspiration and knowledge which lead to success be achieved.

A Handsome Windmill

THE many readers of THE MODEL ENGINEER who are interested in windmills will, I think, be pleased with the accompanying picture which has been kindly submitted by Mr. A. J. Fellows, of Eastbourne. It shows the Ashcombe Mill, which formerly stood on Kingston Hill, near Lewes. It had six sails or sweeps, instead of the usual four, and is generally of particularly clean and pleasing design. It was unfortunately demolished by a gale sometime in 1916 or 1917.

The Cost of a Train

MR. WM. ATKIN has sent me a clipping from the *New York World Telegram*, showing a whole-page advertisement of the Pennsylvania Railroad, which contains some interesting data about the increasing cost of railway trains. It says that in 1906 a train of six coaches and locomotive cost 59,092 dollars. After world-war No. 1 nine steel coaches, a diner, and locomotive cost 257,000 dollars. Today the Pensylvania's overnight coach train, with 14 cars, diner, and steam locomotive costs 1,655,450 dollars, or twenty-eight times the cost of the coach train of 1906. To sum it up, 59,000 dollars once bought a whole train, now a single coach costs 90,000 dollars. Yet in spite of these increased costs, you can travel today for less per mile than it cost in 1906, and there is no comparison in the comfort and general amenities of a railroad journey. The costs in dollars of the present day locomotives are 282,000 for steam, 320,000 for electric, and 625,000 for the 6,000 h.p. diesel.

Those Million Matches

IT will be remembered that a few weeks ago I published an appeal from Mr. C. Bravery, for a million used matches, to enable him to build two new architectural models. This appeal was not made in vain, for Mr. Bravery now writes to tell me that he has been receiving parcels almost daily from all parts of the country. At the time of writing he had received 38,143 matches, apparently all carefully counted! He says that unfortunately he is still confined to his bed, and that letter writing while on his back is not easy. He therefore wishes me to express his grateful thanks to all those friends who have so kindly contributed to his timber shortage. One consignment from a poultry farm near Ormskirk contained over six thousand matches. May I add my own appreciation of all this kindly help to a brother model maker in difficulty.

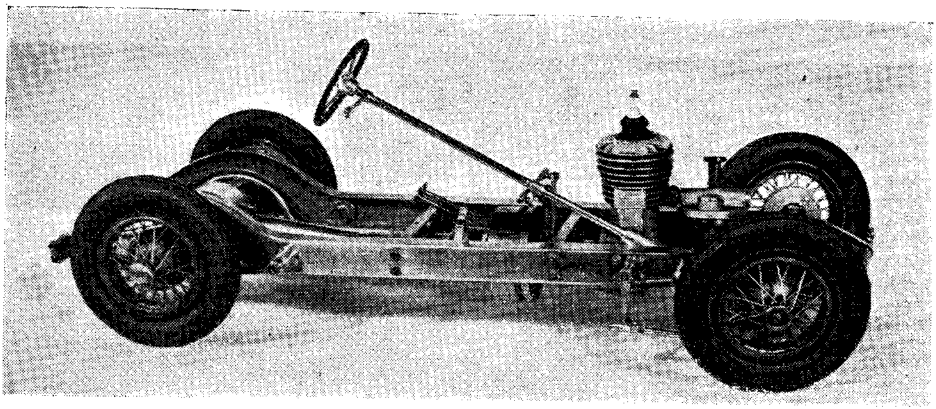
Progress at Falmouth

FROM Mr. Harold V. Eddy I hear that the Falmouth Society is steadily forging ahead. The Royal Polytechnic Society of Cornwall has allocated a fine meeting room for them and its equipment with machine and bench tools is proceeding. The subscription has been fixed at £1, which, Mr. Eddy says, may appear a little high, but the intention is to do everything well. Local interest is very keen and one of the first projects to be taken in hand is the building of a Trevithick locomotive model, as a combined effort for the local museum.

He Wants to See an Engine

CAN any South Wales reader help a correspondent who is anxious to see an example of the two-cylinder over-crank steam winding engine? Replies should be sent to Mr. H. Rowlands, 19, Lower Bailey Street, Wattstown, Glam.

Percival Marshall



Mr. H. R. Hartley's model race car chassis

Sheffield's Fourth Exhibition

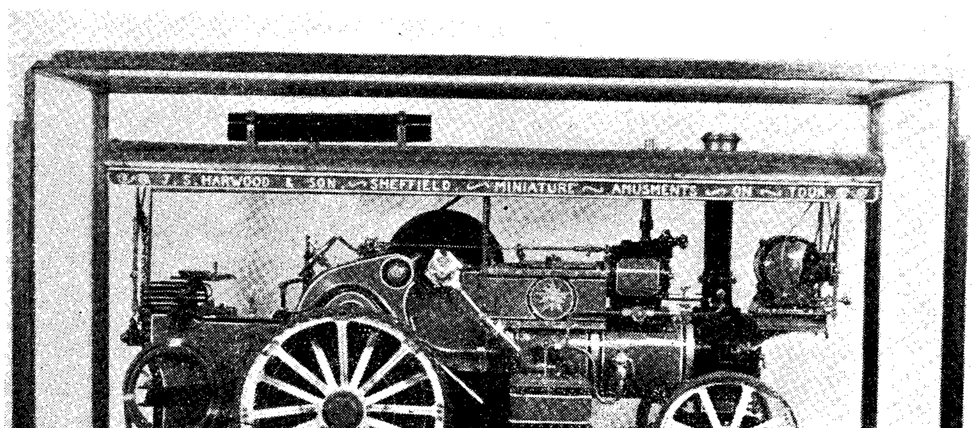
Photographs by R. V. Garside

DURING four days in Easter Week, the Sheffield and District Society of Model and Experimental Engineers held its fourth exhibition, and attracted more than 8,000 visitors. The passenger-carrying track carried upwards of 3,000 people, some of them hauled by locomotives of the West Riding Small Locomotive Society, whose members took over the track on the Saturday afternoon.

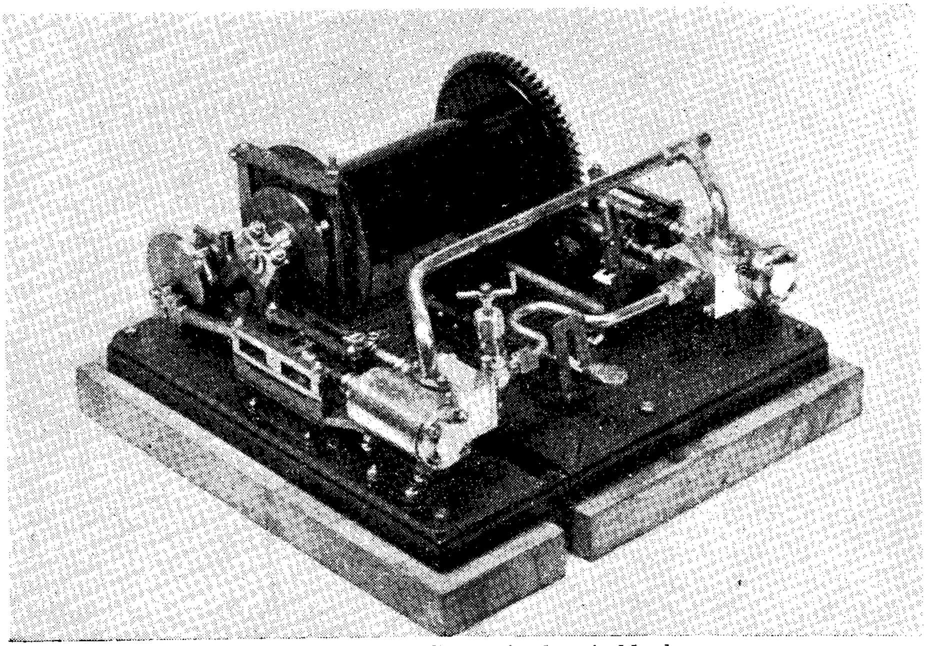
The ship models were judged by "Jason," and we will not poach on his preserves by describing them here. In any case, he can criticise "without fear or favour!"

The other models were judged by Mr. J. N. Maskelyne, who awarded the open championship cup to Mr. H. R. Hartley's race car chassis. This model is fitted with wire-spoked wheels, the spokes being formed from domestic pins; it has a spring steering-wheel, correct steering-gear, laminated road springs and other desirable details. Of beautiful finish, the craftsmanship is excellent.

Mention must be made of about thirty or more models lent by Mr. R. Lucas, from his private collection at Mansfield. They included a delightful, fully-detailed miniature compound



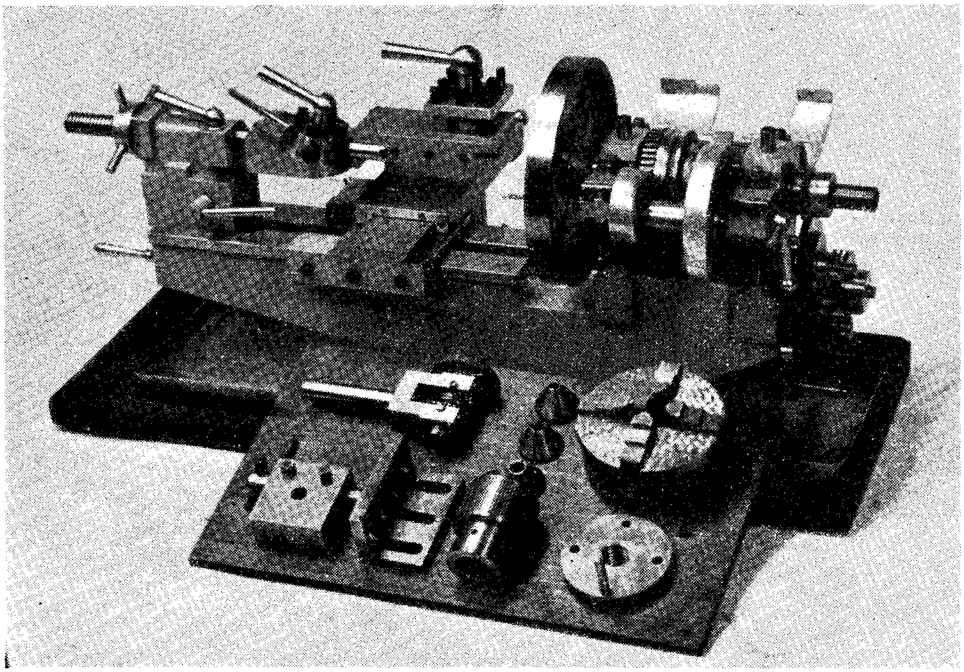
A $1\frac{1}{4}$-in. scale showman's road locomotive by J. S. Harwood



An $\frac{1}{2}$-in. scale winding engine by A. Mordue

marine engine, a $1\frac{1}{2}$-in. scale steam roller, a $1\frac{1}{2}$-in. scale Robey portable engine, a $1\frac{1}{4}$-in. scale American 4-4-0 locomotive of somewhat ancient "vintage," undertype and overtype engines, various $\frac{1}{2}$-in. and $\frac{3}{4}$-in. scale locomotives, several ship models and, as makeweight, a $7\frac{1}{4}$-in. gauge L.M.S. "Duchess" class 4-6-2 locomotive!

The Sheffield Ship Model Society's stand



A 2-in. B.G.S.C. lathe built in a Jap P.O.W. camp by R. Bradley

displayed a large number of beautiful exhibits; the Sheffield Model Yacht Club showed a selection of their boats, and the Sheffield Society of Aeromodellers arranged many aircraft as an attractive "ceiling" to the whole show! These societies also provided stewards, and it is good to know of this cordial and harmonious co-operation. Long may it continue.

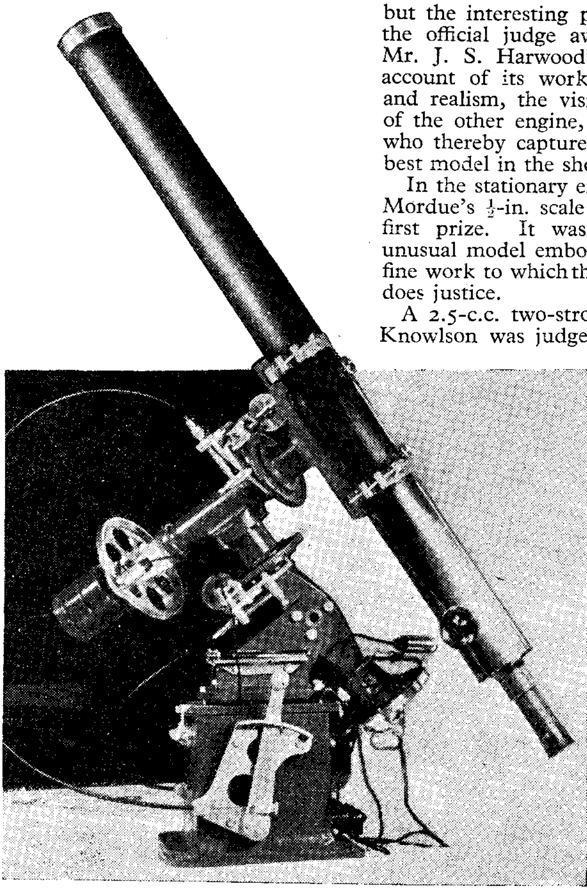
The photographs reproduced herewith show some of the prize-winning exhibits, and include a view of Mr. H. R. Hartley's model race car chassis. The prize-winning locomotive by Mr. R. Kerry, apart from being an excellent job embodying much first-class workmanship, was of interest in that it is based on "L.B.S.C.'s" well-known "Dyak" 2-6-0 tender engine, but doubled in size and converted to a 2-6-2 tank engine.

Among the traction engines in the show, there were two outstanding examples, and each was a $1\frac{1}{4}$-in. scale tractor of the "showman's" type. In the competition, both scored very high marks; but the interesting point is that although the official judge awarded first prize to Mr. J. S. Harwood's engine, chiefly on account of its workmanship, appearance and realism, the visitors voted in favour of the other engine, by Mr. S. Breedon, who thereby captured the prize for "the best model in the show!"

In the stationary engine section, Mr. A. Mordue's $\frac{1}{2}$-in. scale winding engine won first prize. It was an interesting and unusual model embodying a great deal of fine work to which the photograph scarcely does justice.

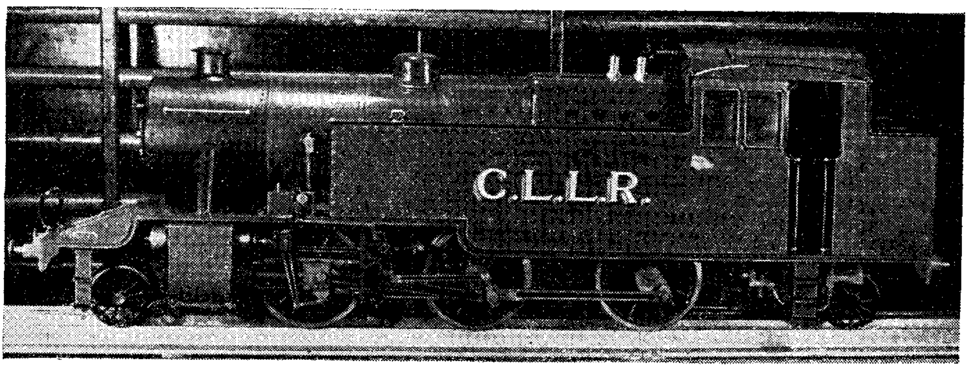
A 2.5-c.c. two-stroke engine by Mr. J. Knowlson was judged to be the best.

A small but useful selection of workshop equipment comprised the tools section. Out of eight exhibits, no fewer than five were home-made lathes, all of which were of excellent quality, resulting in marks being gained within very close limits. Top score went to a 2-in. back-geared, screw-cutting lathe with all necessary accessories, the whole of which had been designed and made by Mr. R. Bradley, while he was detained in a prisoner-of-war camp in Japan.



An equatorial mounting to carry up to 6 in. astronomical telescope. Shown with 3-in. telescope by J. S. Harwood

Finally, there was one outstanding exhibit, which, however, was not in the competition because it was not regarded as a model. It was an equatorial mounting to take up to a 6-in. astronomical telescope, and was a really worthy piece of work by Mr. J. S. Harwood.



A 1-in. scale tank locomotive by R. Kerry

AEOLIAN HARPS

by H. P. and C. R. Ford

IT is, perhaps, remarkable that musical instruments have always seemed to appeal to model engineers, but such is the case. The writers, however, cannot remember having seen any references to Aeolian harps during the last 25 years—in fact, this interesting instrument seems to have been completely neglected this century ; which is rather difficult to understand, as harps of all types have been held in esteem throughout the ages. The earliest reference the writers have been able to find is that of a harp being hung up in the wind to lull King David to sleep.

The principle of the instrument is simplicity itself—consisting, as it does, of strings strained across a sounding-board, or body, and a means used to direct the wind across the strings, which are usually eight, or a multiple of eight, in number. The tuning is interesting, as all the strings are tuned to the same note, but not necessarily to the same octave. The strings normally vibrate, not to give the fundamental note, but the various harmonics thereof ; and, to obtain a rich mixture of harmony, the strings should be tuned fairly slackly and consist of various thicknesses and materials. If, however, the wind blows too vigorously, the fundamental note is heard with the 11th or 13th overtone, and a shrill discord results, but this is fortunately rare.

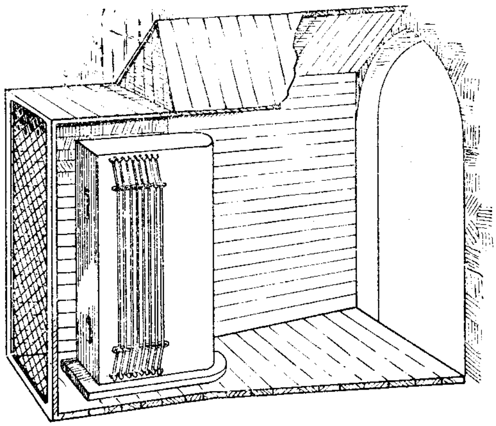


Fig. 1

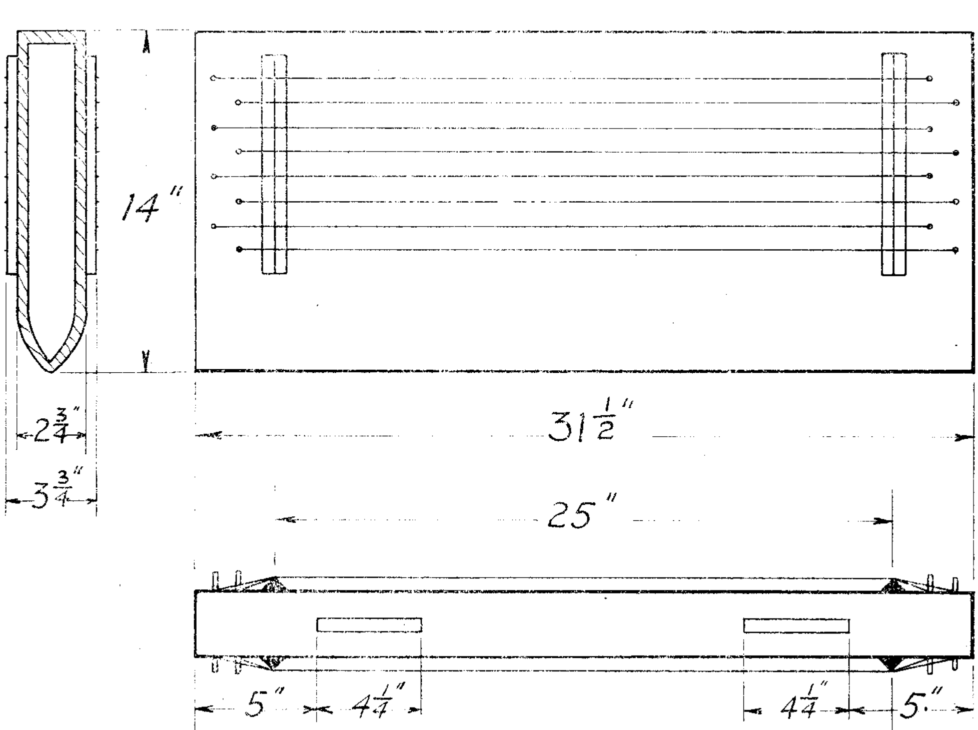


Fig. 2

Perhaps the most famous harps were those at one time installed in the Castle of Baden-Baden. Fig. 1 is copied from an old print of one of the loudest of these harps, of which the date and artist are unknown. This drawing shows very clearly the salient points of construction, and the shape of the body; the means of concentrating the wind on the strings should be noticed. Fig. 2 is a rough working drawing of the sound-box, giving the main dimensions. It will be noticed that the sound holes are at the rear of the body so as to be out of the wind stream.

In Fig. 3 the artist has suggested a design for an Aeolian harp based on the best accepted principles. The body is of the same dimensions as the Baden-Baden harp and should be made preferably of sound $\frac{1}{8}$-in. or $\frac{3}{16}$-in. pine, the ends being of $\frac{3}{4}$-in. or 1-in. hardwood, to give a good hold for the tuning-pegs, which can conveniently be piano pegs. The bridges, which should be made of the hardest wood obtainable, are of triangular section, about $\frac{1}{2}$ in. high and $\frac{1}{4}$ in. wide at the base. The strings should be as varied as possible, catgut, steel, wound gut, and wound steel being used in different thicknesses, to obtain the wealth of harmonics necessary for the tone of the harp. The string ranges can be from the violin E-string to the thinner string used on a double-bass. Incidentally, the artist has depicted the supply of fresh strings sitting on the wall!

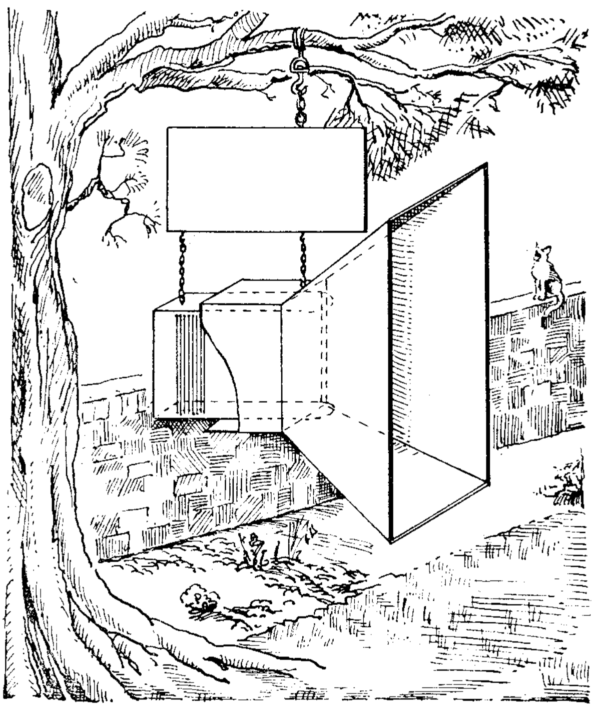


Fig. 3

The wind scoop, vane for keeping the instrument head to the wind, means of suspension, and allowing rotation, are all clearly shown in the diagram, and are left to the ingenuity of the reader. A fact to be noticed is that there should be at least 2 in. or 3 in. clearance to allow the wind to blow over the strings.

To those who are accustomed to string instruments it may be necessary to add that there are no sounding-posts between the two boards, because, being strung on both sides of the body, the sounding-boards vibrate with different harmonics.

The great difficulty with all Aeolian harps lies in the fact before mentioned that a strong wind causes unpleasant discords; therefore, the best effects are obtained with a soft breeze, when the volume may not be quite adequate.

For anyone with the time, a profitable line of experiment would be the use of a microphone button or moving coil attached to the sounding-board and fed to a loud speaker through the necessary amplifier. In this way, a better Aeolian harp would be heard than ever before. The subject is well worthy of the attention of musically-minded readers.

"Blackhorn Handles"

MENTION by "L.B.S.C." recently of his old Milnes' slide-rest being fitted with the above is a reminder that all the lathes, large and small, in a shop I was in prior to 1914, were adorned with this extra bit of polish on the crank handles. Those horns that were well shaped and of the highly polished jet black type were really nice to look at, and such strong tough stuff. The large ones to be found on say, a 16-in. centre lathe, had a feel like velvet, and being loose on the stock, remained stationary in the hand when gripped, there being no rubbing and revolving of the handle in the hand, like with a fixed metal one, thus they were an advantage on a fast geared saddle traverse, but not in the case of the leverage type of movement. Yes, they were on all three handles of Britannia and Milnes machines, up to about 1916, and on the saddle traverse of the latter lathe since, and of course, Drummonds' also fitted them. Burrell's also had them on the steering wheels of their large traction engines. It is so much easier and cheaper to fit what are seen now. By the way, which is the handle, the whole outfit or just the part gripped in the hand?—

"COWHANDLE."

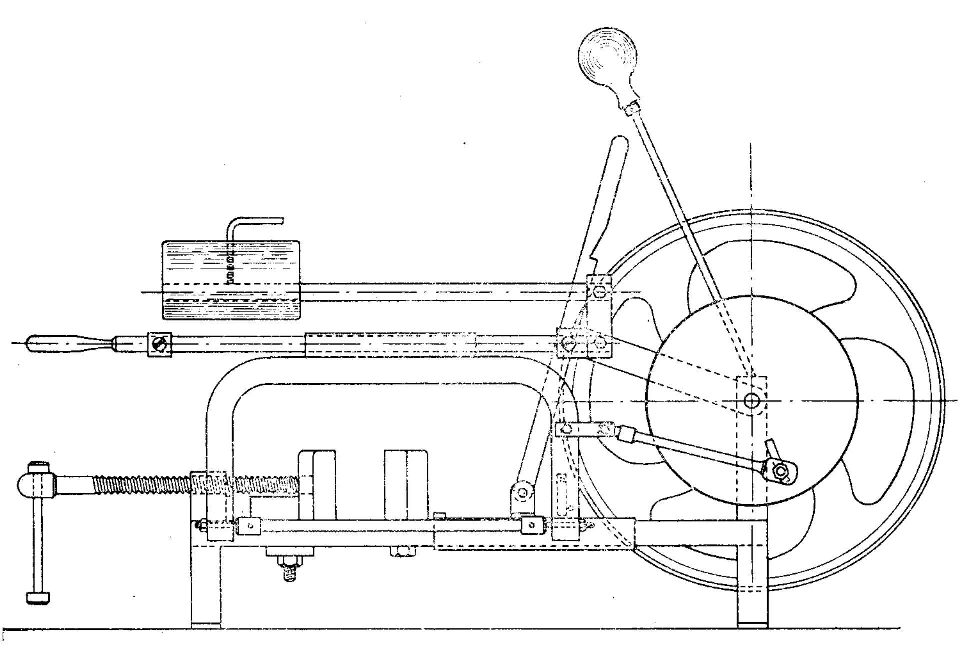
A HACKSAW MACHINE

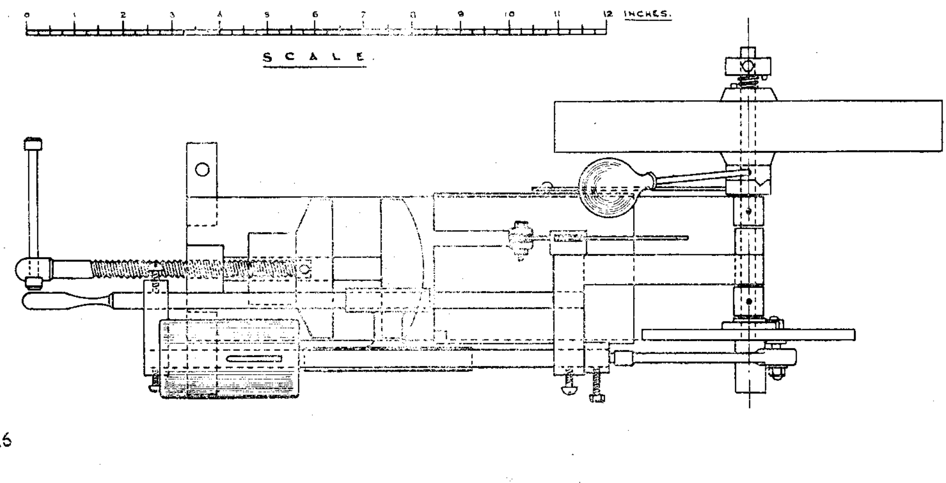
FURTHER DETAILS BY T. SPIKE

THE following supplementary particulars of the hacksawing machine made by Mr. T. Spike, illustrated and briefly described in our issue of March 6th, have been furnished by the constructor in response to many requests.

The base of the machine is made from a piece of $\frac{1}{2}$-in. mild-steel plate, with legs bolted to the four corners, and a slot cut in it to take the vice jaw. For the vertical main bearing supports, two pieces of $\frac{5}{8}$-in. square steel were used, drilled and tapped $\frac{1}{4}$ in. diameter on the under side for attachment to the baseplate, and with a cross hole $\frac{1}{2}$ in. dia. to take the main bearing bushes which are $\frac{1}{2}$ in. diameter, with a $\frac{3}{8}$-in. hole bored through the centre to take the main shaft.

A piece of mild-steel was bent to form the hacksaw frame, two pieces of $\frac{1}{2}$-in. round bar being bored through $\frac{3}{8}$ in. diameter and brazed to the frame with a spacer between them, to form parallel slide members. These work on guide bars $\frac{3}{8}$ in. diameter, attached to the saw frame support, which is pivoted on a bush which

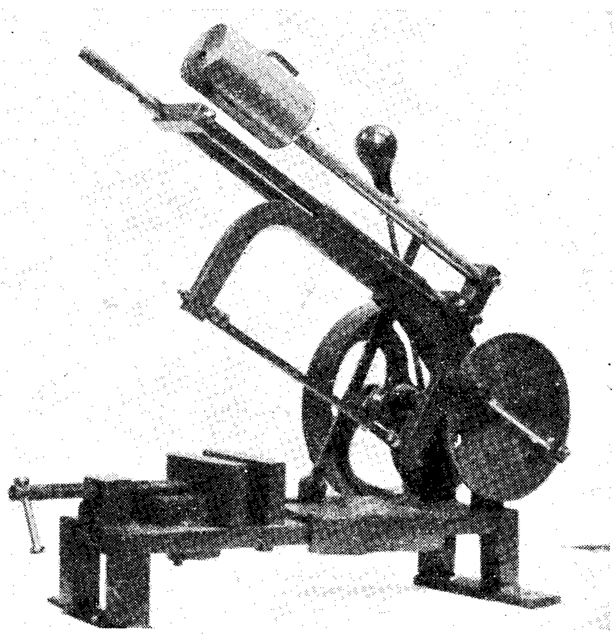




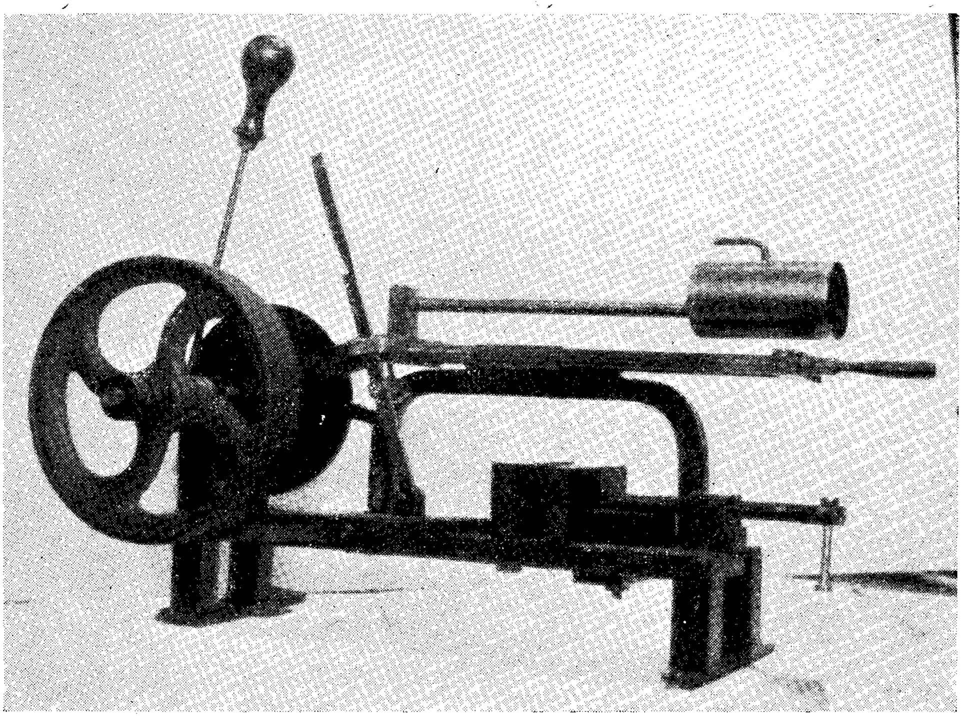
fits the main shaft between the bearings. This structure is fabricated by brazing.

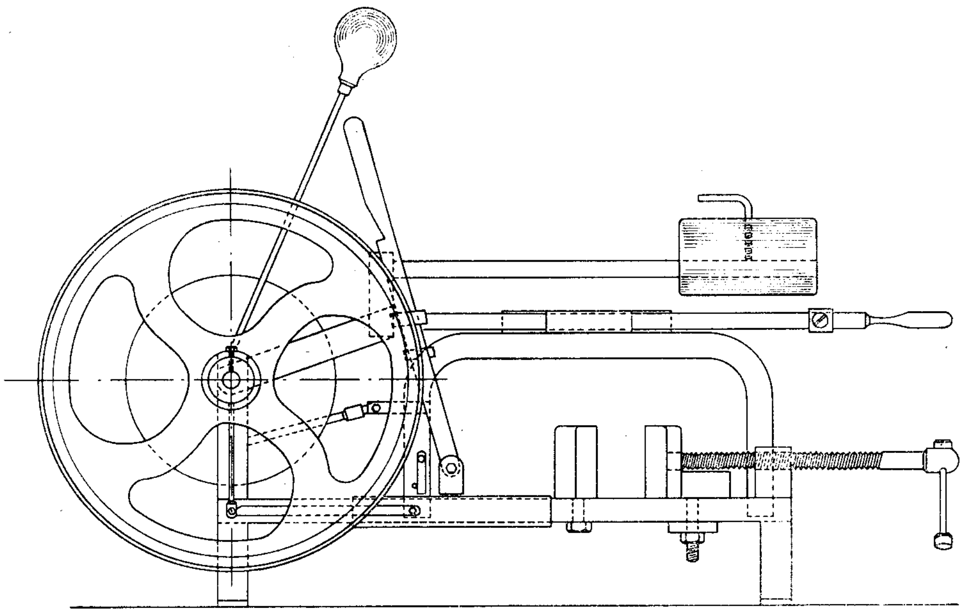
The crank-disc, which drives the saw, is fitted to a $\frac{3}{8}$-in. shaft, and a slot in the face of the disc enables the length of stroke to be adjusted, the crankpin being in the form of a shouldered stud, secured by a nut behind the disc.

The automatic stop works on the same principle as that employed on most machine hacksaws, and calls for no special comment, as most readers are familiar with it. Drive is normally transmitted to the shaft, from the driving pulley, by the pins in the collar at the end of the shaft, so long as the pulley is kept against the collar by the cam-plate to which the starting lever is attached. A corresponding notched cam is fitted adjacent to the main bearing, and connected to the saw frame support in such a way that when the saw falls to its lowest level, the projection on one cam enters the notch in the other, allowing the pulley to move endwise under spring pressure and disengage the clutch.



The vice is made of mild-steel, the fixed jaw being bolted to the baseplate from the underside, and the moving jaw has a flat base brazed on at right angles, and a tongue-piece to fit the slot in

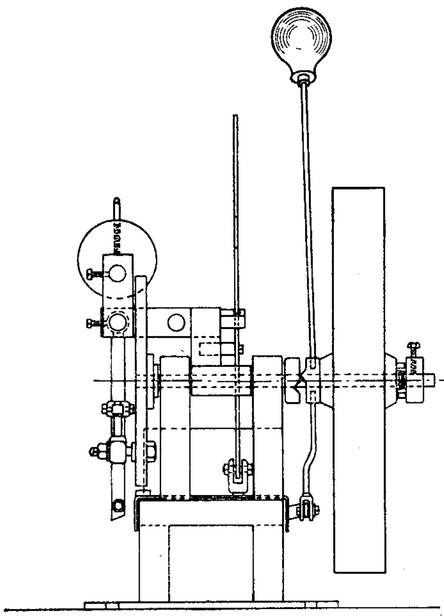


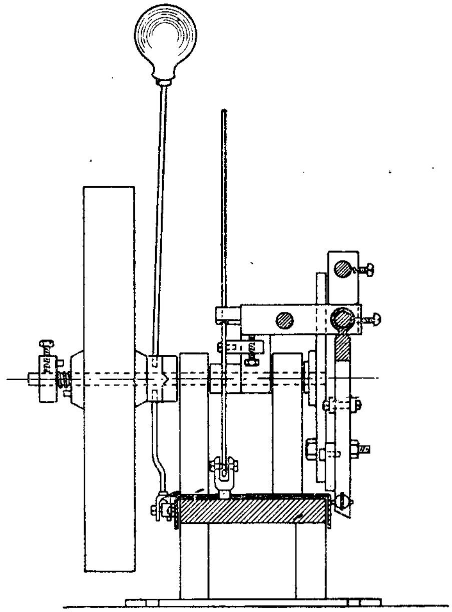


the baseplate. A $\frac{3}{8}$-in. Whitworth thread is cut on the vice screw, working in a tapped hole in a steel block fixed to the baseplate.

Pressure to keep the saw cutting is applied by a weight, the leverage of which is adjustable by sliding it along a rod above and parallel to the slide bars of the frame. The design is capable of enlargement to suit any size of hand or machine saw blade, but the miniature blades used in this machine have proved capable of dealing with quite large work, and have saved the constructor a great deal of hard and tedious labour ; they last quite a long time if used carefully and run at the correct speed, which is about 40 strokes per minute.

The drawings with this article were kindly supplied, free of charge, by Mr. Spike's architect friend, Mr. E. O. Hardings.





★A GAS-TURBINE LOCOMOTIVE for the GREAT WESTERN RAILWAY

IT was recently announced by Lord Portal, Chairman of the Company, that the G.W.R., was investigating the application of the gas turbine to rail traction problems, and the Metropolitan-Vickers Electrical Co. Ltd., Trafford Park, Manchester 17, is now building a 2,500 h.p. gas-turbine locomotive to the requirements of Mr. F. W. Hawksworth, Chief Mechanical Engineer of that Railway.

This locomotive is intended for hauling express passenger trains on the main lines from Paddington to Plymouth, Penzance, Bristol, Fishguard and Birkenhead. These trains sometimes reach 18 coaches in length with a weight of 650 tons behind the engine, and the schedules require speeds up to 90 m.p.h. Sustained gradients of 1 in 80 are not uncommon, and short gradients as steep as 1 in 40 have to be negotiated on the main line between Exeter and Plymouth. To handle such trains on these grades a starting tractive effort of about 60,000 lb. is essential, and an adhesive weight of not less than 120 tons is required. With axle loading limited to 20 tons, this means six driving axles. The locomotive has, therefore, been designed with two bogies each having three axles, and each of the six axles is driven by an axle-mounted traction motor, geared for a maximum service speed of 90 m.p.h. The body, which is carried on the two bogies, has a full-width driving cab at each end, and the power unit with the electric transmission equipment and auxiliary machinery occupies the space between the driving cabs.

The Gas-Turbine as the Prime Mover

The chief interest lies in the gas turbine used as the prime mover. This is of the open cycle type, and the four events of the heat cycle—compression, heating, expansion and cooling—proceed simultaneously and continuously. The compression, in the ratio of about $3\frac{1}{4}/1$, takes place in a multi-stage axial flow compressor running at 6,900 r.p.m. Metropolitan-Vickers was largely responsible (in conjunction with the Ministry of Aircraft Production) for the development of this type of compressor for aircraft jet engines, as distinct from the centrifugal compressor used in the Whittle type jet engines. The compressor used in the gas-turbine locomotive is very similar to that used in aircraft.

The air from the compressor, already heated by the compression process, passes through the heat exchanger, where it takes up more heat from the exhaust gases, to the combustion chambers. Here the fuel oil issuing from high pressure nozzles burns in the primary chambers, which are traversed by a small proportion of the total compressed air, and the extremely hot gases thus produced rejoin and mix with the remainder of the air and raise it to the final temperature before reaching the turbines.

There are two axial flow turbines mounted on separate shafts, and the hot gases flow through them in series. The first is a single-stage wheel driving the air compressor and such auxiliaries as fuel and lubricant pumps, and the second is a multi-stage power-output turbine driving the electric transmission generator and the auxiliary power generator through reduction gearing of ratio 4,500 r.p.m. to 850 r.p.m. The discharge from the turbines passes to exhaust through the heat exchanger, where it increases the cycle efficiency by adding heat to the air flowing to the combustion chambers ; this heat would otherwise have to be provided by burning more fuel.

The air compressor and the power transmission generator are driven by mechanically independent turbines. This arrangement has an important advantage over the single shaft scheme (in which one turbine drives both compressor and generator) in that increasing load on the generator can be met simply by increasing the fuel input ; this speeds up the compressor automatically, resulting in correct fuel-to-air ratio and proper operating temperatures without resort to the special provisions necessitated by the mechanical tie between compressor and load in the single shaft arrangement.

The Power Output

The output from the power turbine is over 2,600 h.p., of which the traction generator absorbs 2,500 h.p., and the remainder covers gear losses and the auxiliary generator input. The interchange of power between the compressor and its turbine is about 4,500 h.p.

A large quantity of air is required as the working fluid of the cycle : at full load the flow is about 44,000 cubic feet per minute or 1.5 tons per minute. To reduce maintenance to a minimum, all this air is filtered through dry fabric filters arranged in a special compartment.

The electrical transmission equipment consists of the main traction generator and the six traction motors together with automatic control gear, which adjusts the machine excitation so as to utilise the full generator input over the wide speed range of 10 to 75 m.p.h. The machines are proportioned to give a maximum tractive effort of 60,000 lb. and can operate continuously attractive efforts up to 23,000 lb., corresponding to 35 m.p.h. This performance is necessary for operating the heaviest passenger trains on all the main lines, and it also enables the locomotive to handle goods trains, thus avoiding an occasional light-engine return trip.

The electrically driven auxiliary machinery comprises air brake compressor, vacuum brake

* The Editor, in his Smoke Rings this week, has drawn attention to some of the developments taking place in the field of Gas-Turbine and Reaction Engines. Readers will, no doubt, be interested in his remarks, which are supplementary to this article, upon the probable trend of development in this field in relation to Model Engineering.

exhauster, traction-motor ventilation fans, and gear-oil cooler fan. These are supplied from 110-volt d.c. auxiliary mains, which are fed from an auxiliary generator mounted on the traction generator shaft and driven by the power turbine. The gas turbine is started by an electric motor fed from a battery, which is kept charged automatically from the auxiliary generator.

The chief claims for the gas-turbine electric locomotive are that it concentrates high performance in small space and weight and that the gas turbine, by virtually eliminating rubbing surfaces, gives high reliability with low maintenance cost. Only an electric locomotive could give better performance within the loading gauge and axle load limit specified, and no other type could even equal it. The fuel consumption is very much lower than for a steam locomotive, and while a diesel locomotive has a still lower consumption figure this advantage is partly offset by the higher and more expensive grade of fuel required and by the much higher lubrication cost.

The leading particulars of the Metrovick gas-turbine electric locomotive are :—

Length over buffers, 68 ft. Bogie wheel base, 15 ft. Bogie centres, 39 ft 6 in. Total wheel base, 55 ft. 6 in. Body width, 8 ft. 10 in. Height above rail, 13 ft. Total weight, 120 tons. Adhesive weight, 120 tons. Maximum speed, 90 m.p.h. Maximum tractive effort, 60,000 lb. Continuous-rating tractive effort, 23,000 lb.

Electrical Specialities

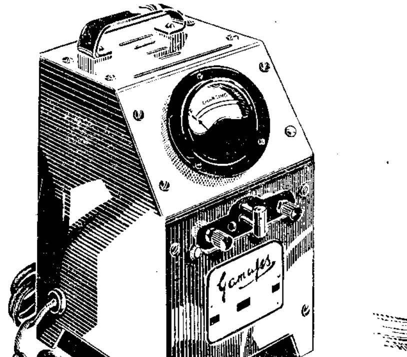
AMONG a wide variety of electrical goods, including both new and war surplus items, Messrs. A. W. Gamage Ltd., of Holborn, London, E.C.1, are now listing a neat and compact battery charger to work from a.c. mains. We have recently had an opportunity of examining and testing one of these units, which embodies a transformer and metal rectifier, housed in a ventilated metal casing, and is equipped with an ammeter showing the rate of charge, and tappings for 6-volt and 12-volt batteries. The charger is supplied in two types, for charging at either 1 amp. or 2 amp. respectively. These chargers are highly suitable for the requirements of model engineers, in the servicing of batteries for ignition, radio or model railway power supply, and are very moderately priced in view of their quality and finish.

A number of small electrical generators of various types are included in war surplus goods, and one of these, a hand driven battery charging generator, is of particular interest. It embodies a hand gearing giving a step-up ratio of 40 to 1, with a detachable hand crank, and the rated output of the generator is 6 volt, 3 amp., but it will stand a considerable overload for short periods. The set is supplied in a padded steel case, with toggle fasteners and carrying straps, and also includes clamps for securing the machine to any convenient support, and spare brushes.

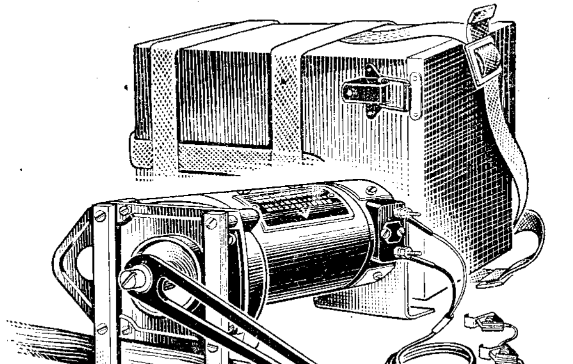
The generator, with gearing detached, might be adapted for use as a motor-cycle lighting generator or for use as a stationary charging plant ; it may also be used as a powerful 6-volt motor for such purposes as driving model boats or electric locomotives. The gearing could be adapted to driving a hand grinder.

Large mains transformers are also available, having an input of 230 volts, and an output of 12 volts, at 70 amps. ; these are suitable for direct power supply of model railways, heavy charging sets, low-voltage projector lighting, etc.

In Gamage's tool department a new and moderately-priced vernier slide-gauge, for internal, external and depth measurement, is of special interest. It is similar to the well-known Columbus gauge sold before the war, and is equipped with thumb-roller adjustment.



The Gamage battery charger, 2-amp. charging rate, for 6 volt or 12-volt batteries.



The hand-driven generator clamped to a bench, ready for use.

THE "IDEAL LATHE" COMPETITION

Entry No. 2 by D. R. Geater

THE bed is of substantial box form stiffened by cross webs and has very wide flat faces for saddle and tailstock.

The headstock is integral with the bed. It has parallel split adjustable phosphor bronze bearings at front and back and a separate ball thrust bearing. The spindle is 1 in. and $1\frac{1}{8}$ in. diameter and is bored to take up to $\frac{9}{16}$ in. diameter bar. The backgear is incorporated in the headstock underneath the spindle, the gears being lubricated by an oil tray.

The cone is designed for 1-in. flat belt but proportions of headstock enable "Vee" belt pulley to be fitted as an alternative. The flanges of the pulley are extended to form oil throwers. The reverse gearing is separate and enclosed in an extension which is bolted on the end of the headstock.

External locking levers are provided for operating backgear and reverse gearing.

The tailstock has a large diameter spindle with internal screw designed for self-ejecting the centre. A screw device is fitted to the tailstock to enable off-setting for taper turning.

The slide rest is of the compound type and can swivel through any angle.

The top slide has a completely covered screw with operating handwheel.

The swivel base is secured to the bottom slide by a special clamping device. A calibrated strip is attached to the front top edge of the swivel base.

The bottom cross slide can traverse the full width of the saddle.

The top face of slide is provided with tee slots to form a milling table when swivel base is removed and holes are also drilled for the registers of a protractor plate which can be instantly fitted or removed.

The saddle is so shaped to permit fullest possible tool travel between maximum centres of lathe and on diameters along bed up to maximum swing over saddle.

The top of saddle has no projections and tee slots are provided for boring operations. The handwheel operating bottom cross slide screw is divided on circumference to register cross feed in half thousands of an inch.

The apron is a separate casting secured to the saddle by fitting studs. Reduction gears, handwheel operated, are provided for easy and smooth racking of the saddle.

The handwheel turns "over" in the same direction as the saddle travels.

A lever and cam operated screw engaging device consisting of a long whole split nut sliding in a complete nut box is fitted.

The apron has an end shield and an extension to cover that portion of the leadscrew which is below the tool carrying slide.

The rack is machined from bright steel bar. It is in two pieces to facilitate renewal in part should wear be predominantly at the headstock end.

The leadscrew is fitted with extra large thrust collars and it runs in phosphor bronze bearings carried in brackets cast integral with the bed. The screw is $\frac{7}{8}$ in. in diameter, and has 4-t.p.i.

Change-Wheels

These are thirteen in number and together with all other gears, are machined from steel blanks. The teeth are 14 d.p. (0.2244 in. circular pitch). The following wheels are included, enabling a useful range of threads to be cut, including all Whitworth up to $2\frac{1}{2}$ in., and B.S.F. up to 3 in.: 16, 20, 20, 24, 28, 30, 32, 36, 40, 44, 48, 56, and 78 teeth.

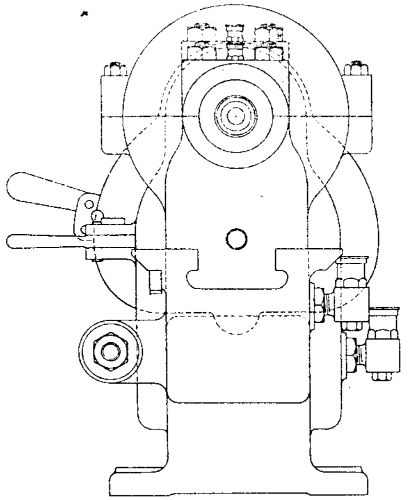
Finger type nuts are used for securing the change wheels. The quadrant is of the single slot type.

The following equipment is specified as being the standard and included in the lathe price :—

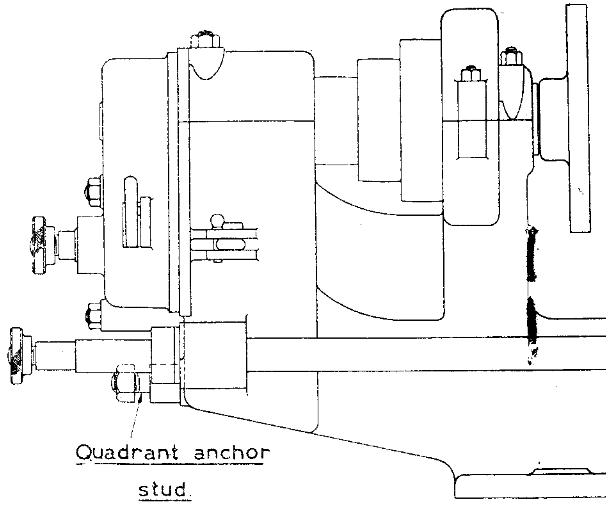
One set of spanners.
One set of eight lathe tools.
One $4\frac{1}{2}$-in. four-jaw (independent) chuck.
One 6-in. faceplate.
One driver stud for faceplate.
One $\frac{1}{2}$-in. carrier.
One 1-in. carrier.
One set of thirteen change-wheels.
One quadrant.
One steady for bolting to saddle.
One pair of centres (one hard and one soft).

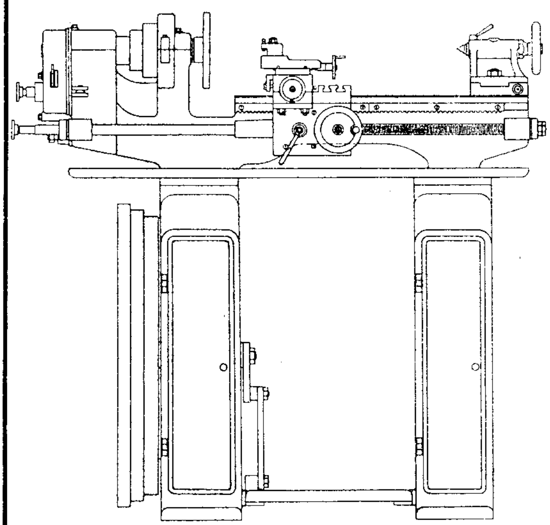
Principal Dimensions

Height of centres ..	$3\frac{1}{2}$ in.
Swing over bed ..	7 in.
,, ,, saddle ..	$5\frac{3}{8}$ in.
,, ,, gap ..	$10\frac{1}{2}$ in.
Length of machined faces of bed ..	$22\frac{3}{4}$ in.
Width over machined faces of bed ..	$5\frac{1}{2}$ in.
Length between centres	$18\frac{1}{2}$ in.
Length of gap in front of faceplate	2 in.
Size of leadscrew ..	$\frac{7}{8}$ in. × 4 t.p.i.
,, cross slide (milling table) ..	$3\frac{1}{8}$ in. × $3\frac{5}{8}$ in.
Size of saddle ..	6 in. × $8\frac{1}{4}$ in.
Size over slotted rings (boring table) ..	3 in. × $8\frac{1}{4}$ in.
Size of cone pulley ..	$2\frac{1}{4}$ in. × $3\frac{1}{4}$ in. × $4\frac{1}{4}$ in.
Size of belt (flat) ..	1 in.
Diam. of spindle ..	1 in. ($1\frac{1}{8}$ in. over threaded end).
Bore of spindle ..	$\frac{9}{16}$ in.
Size of centre ..	No. 2 Morse.
Overall length (over extreme ends of leadscrew) ..	$41\frac{1}{2}$ in.
Overall height (feet to top of 6-in. face-plate)	$12\frac{7}{8}$ in.

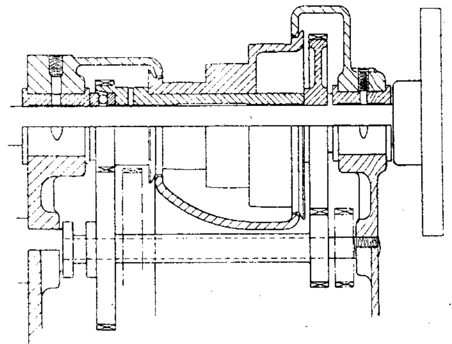


END ELEVATION of HEADSTOCK and BED.

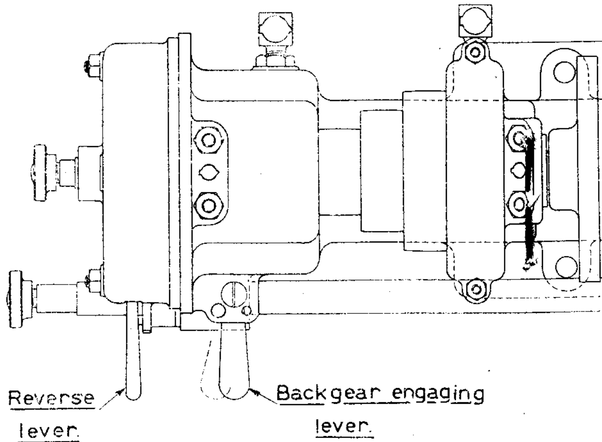


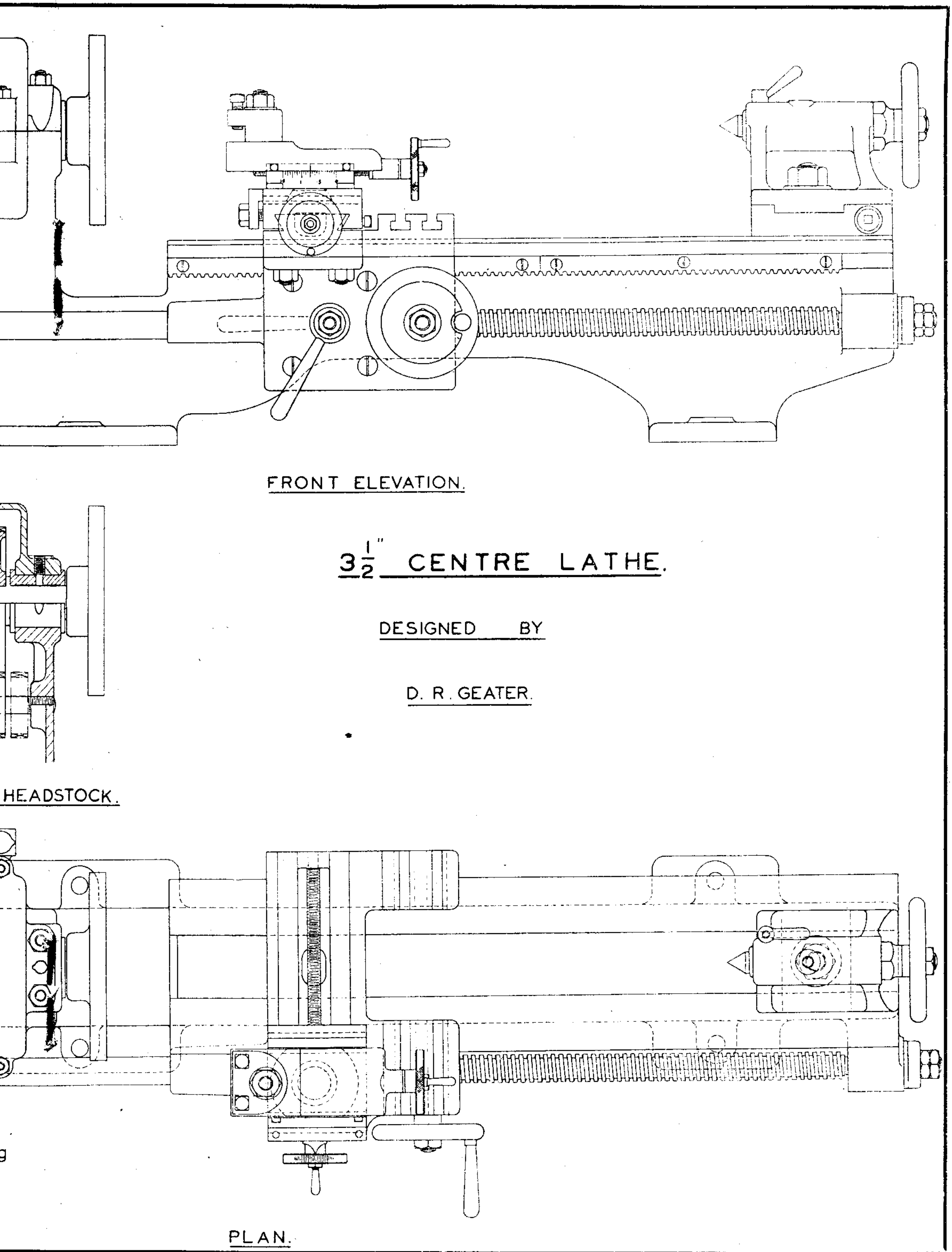


Front Elevation of Lathe arranged for Foot Motor Drive.



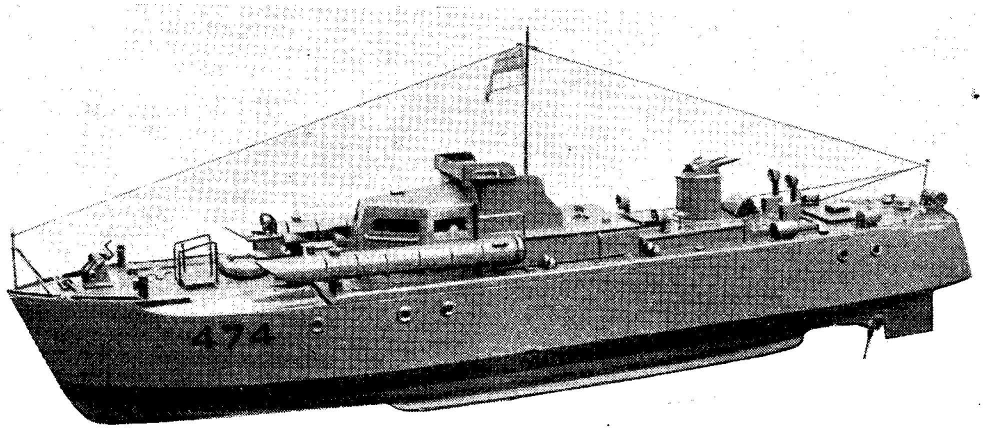
PART SECTION through HEADSTOCK




FRONT ELEVATION.
3½" CENTRE LATHE.
DESIGNED BY
D. R. GEATER.
HEADSTOCK.
PLAN.

FAREWELL TO "UTILITY"

by "Old Gaumless"

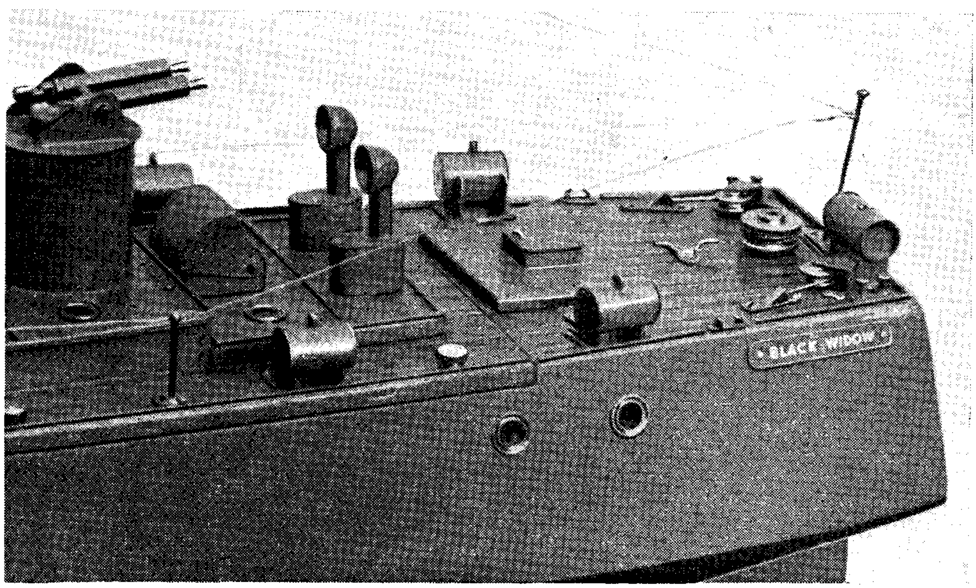


A 39-in. " *Vosper* " *M.T.B.*

THE title of this article may give readers some indication as to what will be forthcoming. It is a description of the latest model ship from our " yard," and we sincerely hope that it is the last model we shall ever be called upon to construct from any odd bits and pieces retrieved from the scrap box, or begged, borrowed and stolen from friends.

First the hull. Carved from the solid with two pieces of " bread and butter " to get the requisite depth. Heaven knows what sort of wood it was, for it was as stringy as an old shirt, and possessed only one redeeming feature . . . no knots !

We will skip the remaining details as to how the model was constructed, for we followed our



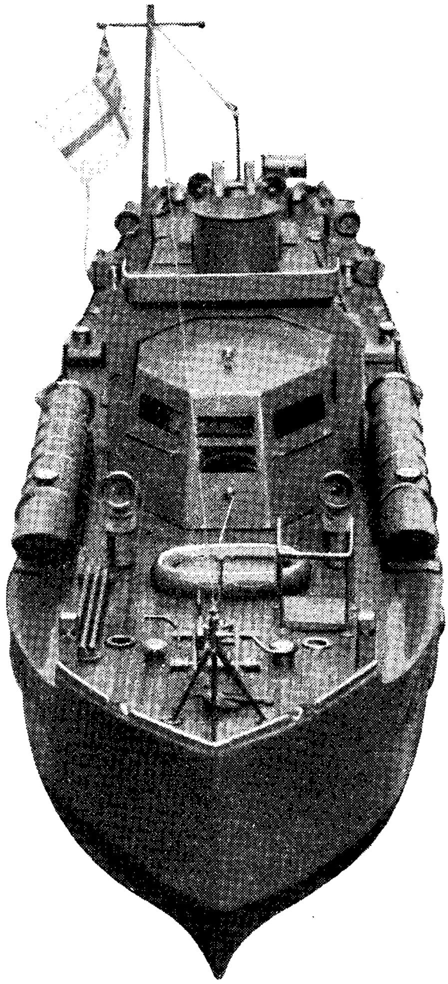
View, showing rudder mechanism

usual practice in most respects and the methods have previously been described in these columns. The engine is another of those oscillators designed and produced by "Gaumless, Jnr." and the water-tube boiler with its three ¼-in. tubes maintains sufficient head of steam to cope with its rather rapacious appetite. The ordinary vapouriser type of spirit lamp was again brought into service and there is no question that the fitting of an exceptionally fine mesh for the aperture is the secret of the longevity referred to in a previous article. Three ounces of spirit burns steadily for 30 mins. and does all that is necessary in the way of "stoking."

Steam—*Alias* I.C.

Our greatest difficulty was just how to disguise the steam plant, for the prototype M.T.B.'s are, of course, driven by I.C. engines. The funnel was, therefore, arranged to just poke its nose above the level of the bildge deck with a removable wooden plug let into the top. And, in like manner, the safety valve top is flush with the same deck so as to be as unassuming as possible. A hinged hatch cover is provided over the engine to admit air, and the exhaust steam is first passed through a "trap" and then led out through two turned brass ferrules driven into the flat stern end. The result is most gratifying and realistic.

Something new are the deck and side lights which were turned up from ½-in. diameter bright drawn brass bar and a ¼-in. thick sheet of "Perspex" was cut up for the "glazing." Cut out with the small hacksaw and then quickly filed up with the rough file until the diameter was slightly larger than the hole in the brasswork, finally pressing home in the vice. This pressing "forced" a good fit and the sharp edges of the brass work removed the excess "Perspex." The front surface was then slightly frosted with fine emery cloth, and to make doubly sure that there would be no leaks, a blob of carriage varnish was run in at the back. When set, the varnish gives a most realistic effect, for the glazing remains transparent to just the right amount.



Detail in plenty

We had run out of thin tinplate and the only thing we could get hold of for the "top-hamper" was lead coated sheet steel. This stuff weighs about 10 cwts. to the square yard, and so we had to be very careful as to the quantity used. Wherever possible, we helped to reduce the weight by using up all the last pieces of decent plywood.

Speaking of plywood reminds us that the deck is made up from pieces of this material which must have originated in some furniture works for the grain is truly beautiful and although we were in some trepidation that the grain would be too pronounced the final appearance is remarkably good. The decking lines are in Indian ink done with the draughtsman's pen, and, instead of using carriage varnish we used cellulose varnish. And we were very glad we did, for this is certainly another "discovery."

Living up to my pen-name, I acted the goat the other day to some purpose! I was called in to discuss a transmission problem at a furniture works and innocently asked if they had any medium which would preserve the bright finish of brasswork, etc. I knew full well that such works use secret preparations with a cellulose base and my bright idea worked, for I was presented with a large bottle of this "cellulose varnish." This medium dries out in a few minutes and imparts a lovely finish just like French polishing to smooth wood surfaces, and preserves the bright metal parts in a most efficient manner. All I want to know now is, where do we get further supplies?

Steering Gear

We now draw your attention to the steering arrangement. This class of vessel lent itself to new experiments and the final arrangement *looks* absolutely correct, even if it does not *work* correctly. The photograph shows just how we set out the job. The steering or rudder post was provided with a turned brass bobbin around which is taken just three turns of Bowden cable (pinched from a cyclist's three-speed gear).

Two guidesheaves are fitted to guide the cable "around the corner" to the hawse pipes. The guide pulleys are straight turning in brass riveted fast to sheet metal frames. The hawse pipes are ⅛-in. copper tube sweated on to a sheet brass base. The cable then travels down below and is secured simply by two electrical staples driven into the floor of the hull.

The result of all this is "friction," the rudder being set by "brute" force and the turns of the cable lock it in any desired position. We shall try this method again with other small ships for it seems to be the answer to our prayers, doing away with such things as quadrants and locking pawls.

We exhibited this latest model of ours at a meeting of our new society in Stockport, where it aroused much interest, but when it came to the question as to "how long it took to make," we are afraid that our statement of about 60 hours raised a few eyebrows. This "time sheet" business can be very confusing, for the model has actually been on the stocks for about two years, being pushed to one side when other more urgent jobs came along, and so one has to be careful when keeping records. However, 60 hours just about covers it.

Colours are the usual navy blue-grey, with a black water-line, and red underwater coat. But the *quality* of the paint is only utility. This is our worst problem at the moment, getting hold of good enamel. We are seriously thinking of going back to "flat" whole colours, where such things as copal are not necessary.

Finally, the model was made at the request of a famous surgeon, who did me a good turn some two years ago. I had collapsed with a stoppage somewhere in the lower regions, where one has a complicated system of tubes. This surgeon took no notice whatever of my suggestion that I be coupled up to the compressed air bottle! What a pity these fellows do not see things through the eyes of an engineer. Or is it?

THE MODEL POWER BOAT ASSOCIATION

At the annual general meeting, held on April 19th, some minor modifications were made in the rules, and details clarified.

It was decided that the minimum affiliation fee should be 10s. 6d. per annum, to cover three members or less, any number of members above this to be affiliated at 3s. 6d. per member per annum. These fees in all cases to include Third Party Insurance, which is compulsory for all entrants in competitions organised by or under the auspices of the association. The question of Second Party Insurance is to be enquired into.

On the recommendation of M. Suzor, of Paris, the possibilities of improving the stability of boats by the use of a two-point bridle, instead of the single tethering plate specified in competition rule No. 10, is to be investigated, and experiments are encouraged in this direction by members carrying out speed-boat trials. The use of the bridle will be allowed in competitions, provided that it can be used in conjunction with the standard line and hooks as specified in competition rule No. 9.

It was decided to amplify competition rule No. 12. (Establishment of Records) by specifying that records may be claimed for distances of 300, 500, 600, 1,000 and 1,800 yards in each of classes A, B and C, and the minimum margin of speed for which a record will be allowed, is one mile per hour over and above the existing record.

Regatta Fixtures

The following dates were provisionally fixed:

International: Sunday, June 8th. Blackheath: Sunday, June 22nd. Victoria: Sunday, July 6th. Guildford: Sunday, August 17th. Grand Regatta, Sunday, August 31st.

Future dates for regattas proposed by clubs should be submitted as early as possible, to enable a complete fixture list to be prepared.

Election of Officers

The following were elected as officers and committee of the association:

President: E. W. Vanner.

Vice-Presidents: Messrs. Percival Marshall, F. J. Pierson and F. Bontor.

Chairman: J. B. Skingley.

Hon. Secretary: Edgar T. Westbury.

Hon. Assistant Secretary: J. Benson.

Committee: Messrs. W. Whiting, (Orpington); J. Cruickshank (Victoria); E. A. Walker (Malden); A. F. Weaver (Victoria); L. S. Pinder (Malden).

Members of provincial clubs are reminded that they may nominate a member of the committee to act on their behalf at committee or general meetings.

In view of the poor attendance at the annual general meeting, an appeal is made to all members of model power boat clubs to take a greater interest in association proceedings. There is no lack of enthusiasm for model power boats, as proved by the success of last season's regattas, but the improvement of running facilities and other advantages for which the M.P.B.A. is constantly striving, can only be obtained by the united efforts of all concerned. At present the membership of the M.P.B.A. is insufficient to enable any bold policy to be carried out. We naturally want your affiliation fees to provide the sinews of war—but even more, we want your support, your opinions, advice, and criticism to shape our policy and add weight to our decisions.

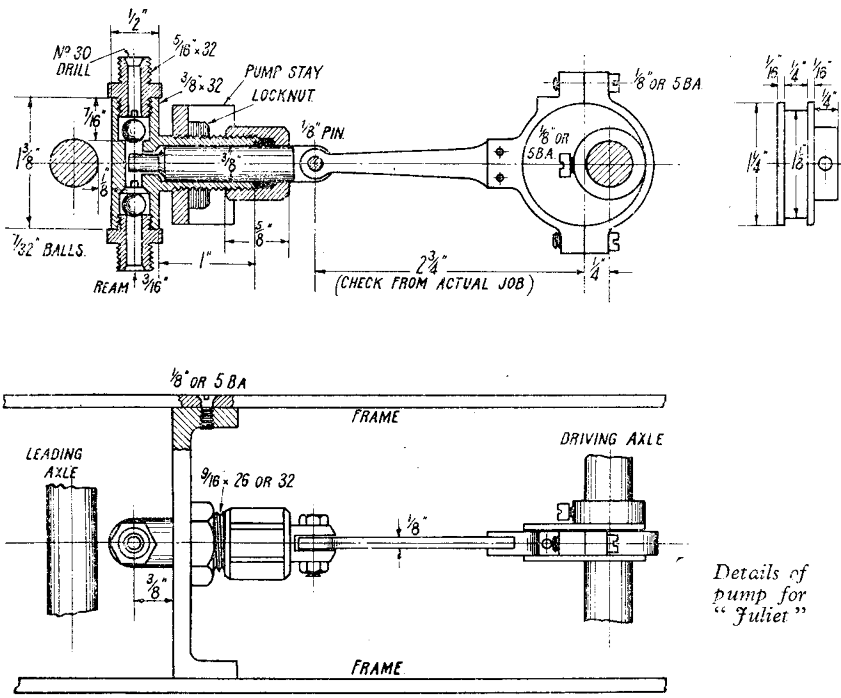
Hon. Secretary: EDGAR T. WESTBURY, 10, Oakhurst Rise, Carshalton Beeches, Surrey.

"L.B.S.C." DESCRIBES THE BOILER FEED PUMP FOR "JULIET"

SOME new readers of this journal who have started to build "Juliet," have raised a bit of a moan because I referred back to the notes on the smaller boiler feed pump for the "Lassie" for details, illustration, and general instructions on making up a similar gadget for the little tank engine. They say they are completely stuck because they can't get hold of the necessary back number, and our "Production editor" suggests that I should "come to the aid of the party" in a manner of speaking, by giving a separate drawing and a few notes on the missing link. All sereny, anything to oblige; I freely admit the grievance is perfectly legitimate, but at the time I referred back, the issue concerned was still obtainable, and, in fact, many builders who fell in love with "Juliet" when that young lady first made her debut, had the back number barrel. The former job can be done in the lathe, by clamping the casting under the slide-rest tool-holder, and traversing it across an endmill about $\frac{3}{4}$ in. diameter held in the three-jaw. You can set the casting square by putting on the faceplate, and running the slide-rest up to it, setting the flange on the casting to touch the faceplate full length, then tightening the clamp. Careful hand filing, checked with a try-square, will also do the trick. As for the hole, that is drilled plumb in the middle of the casting. Drill a $\frac{1}{8}$-in. or $\frac{3}{16}$-in. hole first, as a pilot; then follow up with 33/64-in. drill, and tap $\frac{9}{16}$ in. by 26 or 32.

Pump-barrel and Valve-box

Chuck the casting by holding one end of valve-box in three-jaw, and set the other end to run truly. Face, centre, drill right through with No. 14 drill, open out and bottom to $\frac{7}{16}$ in. depth with 11/32-in. drill and D-bit, and tap $\frac{3}{8}$ in. by 32, taking care not to let the tap scrape the seating. Countersink the hole very slightly and skim off any burr. Reverse and re-chuck on a stub mandrel held in three-jaw; this is a bit of brass rod $\frac{1}{2}$ in. diameter or so, with the end turned down for about $\frac{3}{16}$ in. to $\frac{3}{8}$ in. diameter,



Details of pump for "Juliet"

handy, and so had no trouble in making the pump. Well, here's all the doings in brief.

The cross-stay carrying the pump is a casting which can be supplied by Simmonds, Haselgrove, or any other advertiser supplying "Juliet" castings and material. The only machining it needs, is facing off the two side flanges, and drilling and tapping the hole for the pump

and screwed $\frac{3}{8}$ in. by 32. Repeat operations as on other end, except that the D-bit isn't needed.

Next, chuck by the piece provided, opposite the barrel, and set the barrel to run truly. Face, centre, and drill 7/32 in. until the drill breaks into the passage-way in middle of valve-box, then open out to 1 in. depth with $\frac{3}{8}$ in. drill. Turn down the outside to $\frac{9}{16}$ in. diameter, and screw $\frac{9}{16}$ in. by 26 or 32. Face off the end, so that the barrel is 1 in. long. Finally poke a $\frac{3}{16}$ in. reamer through the hole in middle of valve-box.

Seat a 7/32-in. rustless steel ball on the D-bitted seating, and take distance from ball to top of box with a depth gauge. Chuck a bit of $\frac{1}{2}$-in. hexagon brass rod, and turn down to $\frac{3}{8}$ in. diameter, a length 1/32 in. less than the distance just mentioned above. Screw $\frac{3}{8}$ in. by 32, and part off $\frac{5}{8}$ in. from the end. Reverse in chuck, turn down $\frac{1}{4}$ in. length to $\frac{5}{16}$ in. diameter, screw $\frac{5}{16}$ in. by 32, centre deeply, and drill right through with No. 30 drill. Cross-nick the end, so that the ball does not block the passage-way when it rises. Repeat operations for the lower chamber of the valve-box, but this time turn the end of the cap to the same length as distance from ball to end of valve-box. Drill the cap No. 14, and ream $\frac{3}{16}$ in. Face the end, removing 1/32 in. of metal, and seat the ball on the end of the cap, cross-nicking the hole in the valve-box with a little chisel, home-made from a bit of $\frac{3}{16}$ in. round silver-steel. If the caps are then screwed in tightly, as shown in the section, no jointing material need be put on the threads, as the faced shoulders of the caps should seat steam- and water-tight against the faced ends of the valve-box. I have known of several pump failures caused by beginners allowing jointing material to get on the ball seats and prevent the balls closing the passages completely, so that water just "see-sawed" back and forth in the pump.

Screw the barrel of the pump through the hole in the stay, and put a lock-nut on; making that from $\frac{7}{8}$-in. round or hexagon rod is a very easy job which needs no detailing. Have the pump valve-box at right-angles to the stay, and parallel with the side flanges; although it will work even if erected all cock-eyed, it doesn't look so well!

Ram and Gland

The pump ram is a $2\frac{1}{8}$-in. length of $\frac{3}{8}$-in. round rustless steel, bronze, or gunmetal rod. It should need no turning to fit the pump-barrel, but the end is reduced to form an anti-airlock pin (Curly's "patent!") which makes certain that the pump always delivers full measure, and does away with any need for an air chamber. Chuck in three-jaw, and turn down $\frac{5}{16}$ in. length to $\frac{3}{16}$ in. diameter, bevelling off the shoulder to the same angle as the point of the drill used for the barrel; see longitudinal section. Drill a cross-hole $\frac{3}{16}$ in. from the other end, with No. 32 drill, and ream it $\frac{1}{8}$ in.; then round off the end, and slot it $\frac{1}{8}$ in. wide and about $\frac{7}{16}$ in. deep, by the method I have so often described for valve-gear forks and such like jobs.

Although I have shown the gland made from round material $\frac{3}{4}$ in. diameter, with longitudinal slots in it for operation by C-spanner, there isn't the slightest objection to anybody making it from hexagon rod if they so desire. It is made exactly as described in my instructions to beginners for making union nuts, except that it is drilled $\frac{3}{8}$ in., opened out with 33/64-in. and tapped $\frac{9}{16}$ in. by 26 or 32 to match the pump barrel.

Eccentric, Strap and Rod

These are made as described for the valve-gear components of similar pattern, so only brief mention will be needed. The eccentric, or "tumbling block" as the old enginemen termed it, is turned from a bit of $1\frac{1}{4}$-in. steel shafting held in three-jaw, the groove being formed with a parting tool. Part off at $\frac{5}{8}$ in. from the end. The tool marks will indicate the true centre; at $\frac{1}{4}$ in. away, make a centre-pop, and then chuck in four-jaw with the pop mark running truly. Drill first $\frac{1}{8}$-in. or No. 30, open out with 31/64 in. and ream $\frac{1}{2}$ in. Mount on a bit of round rod, and chuck in three-jaw with the groove nearest chuck; then turn the boss to $\frac{3}{4}$ in. diameter and $\frac{1}{4}$ in. wide. Drill it No. 40 and tap $\frac{1}{8}$ in. or 5-B.A. for a set-screw.

The strap is cleaned up with a file, the lugs centre-popped and drilled No. 40. Saw across, using vice jaws to guide the saw. Tap the holes in the lug half $\frac{1}{8}$ in. or 5-B.A., and open out the holes in the other half with No. 30 drill. Smooth off saw marks, join halves together with screws, chuck in four-jaw with hole running as true as you can get it (it will now be oval) and bore out to fit nicely on the eccentric. Face one side whilst still chucked, and mount on a stub mandrel to face the other side.

Slot the lug either by milling or filing, and fit a steel eccentric-rod $\frac{1}{8}$ in. in thickness, to shape shown, but don't drill the hole in the end, nor file the eye to shape, until after the pump has been erected. The exact length of the eccentric-rod should always be ascertained from the actual job, so as to get the right clearance between ram and end of barrel.

Erection

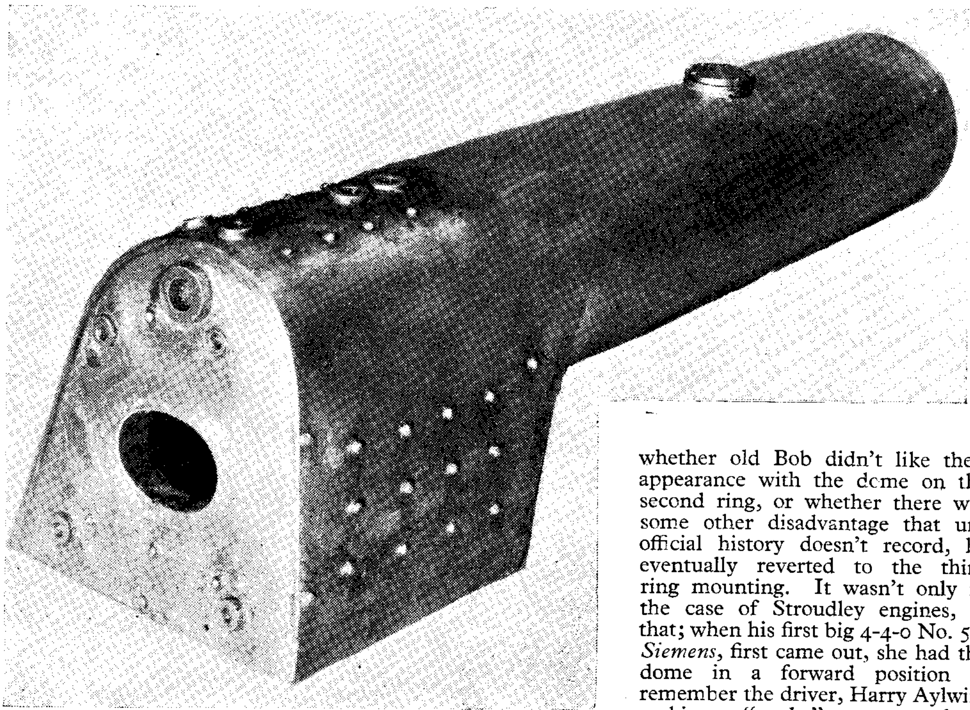
This is an easy job. Just set the pump-stay level with bottom of frames, with the valve-box vertical, and $\frac{1}{8}$ in. behind the leading axle. Run the No. 30 drill through the holes in frame, making countersinks on the pump-stay flanges, follow up with No. 40, going right through, tap $\frac{1}{8}$ in. or 5-B.A., and put in countersunk screws to match. Push the pump ram back in the barrel as far as it will go, place end of eccentric-rod in slot, and with a bent scriber, mark the position of the cross-hole in ram, on the end of the eccentric-rod. Remove rod, make a centre-pop 1/32 in. nearer the strap, than indicated by the scriber mark. Drill the hole No. 32 and ream $\frac{1}{8}$ in., then file the outside of the eye to shape around the hole. You can case-harden it if you like, as described for valve-gear and other eyes, or drill the hole $\frac{3}{16}$ in. and fit a little $\frac{1}{8}$-in. bronze bush. Make a wrist-pin or gudgeon-pin from a bit of $\frac{1}{8}$-in. round silver-steel, reduced at both ends to 3/32 in., screwed, and furnished with nuts; pack the gland with a few strands of graphited yarn, or a bit of unravelled hydraulic pump packing (this is not graphited, but im-

pregnated with a special lubricant) screwing the gland up just tight enough to prevent leakage, but not tight enough to bind on the ram.

Different Folk, Different Fancies

A quibble was recently raised in the correspondence columns about the position of the dome on the Stroudley engines of the L.B. & S.C. Ry., the writer of the letter stating that, *in his opinion*, they were set too far back. Well, to anybody familiar with the construction of the engines, the question of the dome position is one that answers itself, in a manner of speaking, as the Cockney boy realised when he said to his new girl friend, " What's your moniker ? " and she replied with a smile, " Monica Watts." The barrels of the Stroudley boilers were made in three rings, and the dome was set on the third ring. Had it been mounted on the second ring, the complaint would probably have been that it was too far forward ; whilst had it been placed in what the writer of the letter apparently considered the correct position, it would have come slap on the circumferential lap joint between the second and third rings, and I can hardly imagine the immortal Billy emulating Muggins of that ilk, and pulling a boner of that description !

As a matter of fact, when Bob Billinton first started reboilering the " D " and " E " class tanks, he actually did mount the dome on the second ring, putting the whistle on a manhole cover over the firebox wrapper ; but I never heard any of the enginemen, nor in fact anyone else, express the opinion that the appearance of the engines was thereby improved. Their working certainly wasn't, for the new boilers, being injector-fed with cold water, instead of hot water pumped in, burned more coal, and our pockets suffered accordingly. Anyway,



Boiler similar to " Hielan' Lassie's," built by Mr. Calf and brazed by Mr. Hollings

whether old Bob didn't like their appearance with the dome on the second ring, or whether there was some other disadvantage that unofficial history doesn't record, he eventually reverted to the third ring mounting. It wasn't only in the case of Stroudley engines, at that; when his first big 4-4-0 No. 52, *Siemens*, first came out, she had the dome in a forward position (I remember the driver, Harry Aylwin, making a " rude " comment about it) but the later engines of the same class, built by Sharp Stewart and Co. at "tomato" price per lb.—it worked out exactly at the current price of tomatoes at the time the engines were built !—had the dome set farther back. This was also the case with the big radial tanks ; see illustration of 405, *Fernhurst*, on page 364 of Dendy Marshall's *History of the Southern Railway*. Incidentally, this picture gives a good idea of how engines were *really* cleaned in the good old days.

The same correspondent said he considered the Stroudley cabs ugly. Well, " you pays your money and you takes your choice " ; some folk consider the Epstein statues are beautiful and artistic, and your humble servant, plus thousands more, reckon the " M.N.," " W.C.," and " Q1 " classes on the Southern Railway to be the most horrible nightmares that ever set wheels upon rails. A " Johnson " type Midland cab, whatever merits might attach to its outline on a Midland engine, would have looked a bit of a fright on a Brighton engine, and what the drivers and firemen would have said about the short roof, would have raised the steam pressure to blowing-off point without the bother of lighting a fire in the box. However, the significant fact is just this : that when Bob Billinton came from

the Midland at Derby, to take the place of the deceased and ever-lamented Billy, he couldn't have thought very highly of the Johnson cabs because he promptly perpetuated Billy's cab, except that the weatherboard had a curved front and a curved roof, instead of Billy's straight front and dished roof. The reason for this small variation is plain for any unprejudiced person to see, inasmuch as it was a cheaper form of construction. Old Bob was a rum character in many ways, and cantankerous to boot (although, strictly speaking, it wasn't Bob himself, but his unfortunate ailment, which was the trouble; it "got him" in the end, alas!) but he deserved the highest credit for sticking to Billy's colours, and keeping the rule of "every man to his own engine" as far as possible. Also the cap badge he designed, was artistic and distinctive; I still have mine.

Ah well! forgive a rambling reminiscence; but if anybody starts shying metaphorical bricks at my dearly-loved darlings—now, alas! no more—I just have to hold forth in their defence. Anyway, the little reincarnation that is coming into being on my bench, will have the dome in the place her big sister carried hers, although I could put it anywhere between cab and chimney, seeing that the boiler is made from a single sheet like "Juliet's." Also, she will have a straight-fronted cab with a dished roof; and let me whisper in your ear—that wonderful magician of the pencil, locodelineator F. C. Hambleton, has been kind enough to draw for me, an exact reproduction of big sister's number plates, so that the plates the little girl will carry on the sides of the before-mentioned cab, will be something that Inspector Meticulous and every relation and friend of his in the whole wide world, won't be able to find fault with. She will also have working sanding gear; and with my arrangement of link-motion and valve-setting, she should be able to confound everyone who "goes by the book," as far as tractive effort and acceleration are concerned.

An Impromptu M.I.C.

Incidentally, I can clear up one point that has puzzled many students of locomotive lore, and that is, why big *Grosvenor* was apparently a slower starter than the other engines of class "G." The cause was in the valve-setting, which was slightly different from that on the others, and she had $\frac{1}{8}$ in. inside lap, which is fatal to quick acceleration. To the best of my knowledge and belief, the valve timing was never altered. The best of the "G" class single-wheelers, for getting away smartly without any sign of a slip, was old *Fairlight* (Charley Winslett's engine, No. 331) and she had 1-in. laps and over $\frac{1}{4}$ in. of lead. If any "knowledge-box" as we used to call them in the locomotive sheds, starts in to dispute that statement, he is speaking out of turn, because I saw it with my own pair of eyes.

Four young scallywags on duty in the otherwise deserted locomotive shed on a Victorian Sunday afternoon—your humble servant was one of them—found that particular engine with the steam-chest cover off, for the purpose of facing the ports and slide-valves; and being like the "inquisitive kiddy" in the old-time music-hall song, "Of an enquiring turn of mind," we decided to do a little investigating into the mysteries of valve-setting. With the aid of a pinchbar, a couple of torchlamps, and a pocket mirror, we set to work with all the earnestness and gravity imaginable. Young Curly, naturally, knew the fitting-shop method of getting the exact dead centres, and we found the marks on the guide bar all right; by aid of those, and chalk marks we made on the rim of the driving wheel, we got the dead centres "as near as makes no odds," as they say in the classics. To our great surprise, when we took a look in the steam-chest to see where the slide-valves were, the port on the dead-centre side was well open, over $\frac{1}{4}$ in. I thought, maybe, the lever wasn't in full gear, so one of the boys went up in the cab to investigate, and found that it was. He called out for us to watch the valve whilst he worked the lever (we always called the reverser a "lever," whether it was either a "pole" or a wheel-and-screw) and we saw the port open a bit more as the links passed mid-position, then come back approximately to the same place in full back gear. This began to get interesting, so we tried all four dead centres and found the leads approximately equal, then measured the valves, and the distance between the outer edges of the ports, and became so engrossed in the job that we never noticed that the "boss," who had come in unexpectedly for some reason unknown to us, was coming down the shed!

He naturally wanted to know what the blue-pencil we were up to, so we just said we had finished our cleaning, and finding the engine with the steam chest cover off, were trying to learn a bit about the valve movements. Instead of "flying off the deep end," as would probably be the case at the present time, he said he was glad to find us taking intelligent interest in the job, and hoped we would keep it up, and eventually become first-class drivers with a full knowledge of the engines. To cut a long story short, as Nat Gubbins would remark, he spent an hour with us explaining many "whys and wherefores"; and one of the things he told us was, that a big lead such as *Fairlight* had, could not cause any "back kicking," because the port on the other cylinder would be wide open, and the crank in the best position to take the thrust. We could see that for ourselves, by observing the position of the cranks, for he directed us to pinch the engine back until the steam port was just cracking, and then take a look underneath. We saw that the crank on the side just open to lead, was only just off the dead centre, and even full steam pressure on the piston head would not have forced it to move in the reverse direction; whilst the one on the other side was practically right down, the steam port wide open, and the piston "getting the lot."

I have tried in these notes to pass on useful information, as followers of them know full well; but whatever I could write, and in whatever way I could word it, such information could never be so convincing, nor so easily grasped, as when demonstrated on a full-sized locomotive by an official of many years' practical experience, who knew exactly what he was talking about.

*A Tandem Compound Engine

by "Crank Head"

ALL the larger pipes on the model, some of which were ½ in. diameter, and others ⅜ in., but all thin-walled, were bent with the aid of the tool (Fig. 28), even the discharge-pipe from the air-pump, which was definitely awkward, and the results left little to be desired. The chief objection to this tool is that separate rollers must be made for each different sized tube.

The air-pump was the next item to claim attention. Fig. 29 is a sectional elevation of it, and apart from nuts, bolts and studs, there are 48 pieces involved in its construction. The original intention was that the air-pump should be of the Edwards type and single-acting, as this design would have involved much less work in its construction; but investigation of the capacity revealed that the stroke would have had to be very long, and the diameter very much greater than that now fitted. The next obstacle to be met was the fact that nothing large enough in diameter was available; so, to retain the existing diameter, the stroke would have to be greatly increased. The drive for the pump being by eccentric, double the present stroke which, by the way, is ½ in., would have been necessary, and this, of course, was out of the question. The only solution was for the pump to be double-acting, 1¾-in. bore by ½-in. stroke. Then the fun began. It must be remembered that, at the time this was under construction, no castings could be obtained, even if one made the patterns; so the whole pump had to be fabricated.

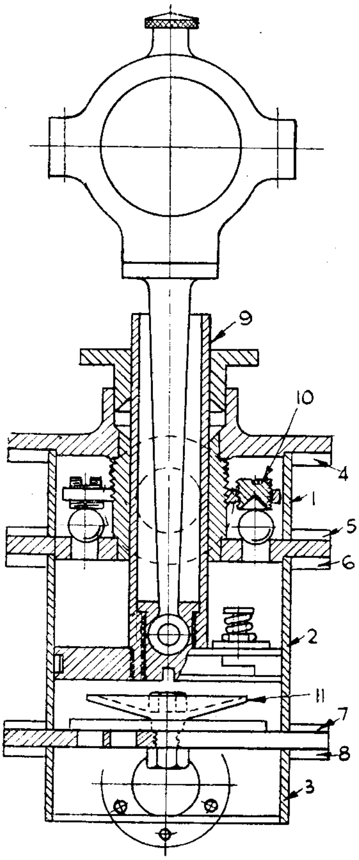


Fig. 29

A piece of solid-drawn brass tube, which was once a portion of an Evinrude outboard motor and approximately 1¾-in. inside diameter, was available and from this the body of the pump was made. Three pieces, Fig. 29, 1, 2, and 3, were cut off, and the ends turned up square, and to the requisite length, allowing about 1/32 in. to be cleaned off after the flanges were in position. These were all the parts that were required to make the body.

Next came the flanges; another three pieces were cut from the tube, each annealed, split down one side and flattened; each piece provided the material for two flanges. After the required number of pieces had been cut they were centred, and bolted on to the face-plate of the lathe, one at a time, and bored to fit the external diameter of the three pieces previously referred to. Before they were removed from the lathe, they were cut to the external diameter required, by using a thin parting-tool and when finished were just washers, the diameter of the bore to fit the external diameter of the tube, and the overall diameter the finished size of flange, as they became when silver-soldered to the three lengths of tube.

The pieces of tube with the flanges on were now set up in the lathe, and finished, i.e., faced up and cut to length. Pieces 1 and 2 were bored in order to make sure they were truly cylindrical; it was found that 0.004 in. was all that was necessary to remove, which proved to be a good thing, because the tube was none too thick originally. No. 3 length did not require boring, as the circularity of this did not matter.

The next thing required was the seating for the head-valves, Fig. 31; this was a portion which required careful handling, as, apart from being the head-valve seat, it carried the guide for the trunk, which must be absolutely concentric with the air-pump barrel, 2, Fig. 29, in addition to being the guide for the trunk 9, Fig. 29. This guide spigots into the top cover of the pump, and forms the lower portion of the cover stuffing-box, so it will readily be seen how necessary it is for this part to be accurate.

To get back to the valve-seat, a piece of sheet brass was faced up on one side, and bored centrally to take the guide. The guide was then roughly turned and bored, and a spigot turned on one end which had to be a shrink-fit in the bore of the piece which had been faced up. The two pieces were then shrunk together. When cold, the whole thing was set up in the chuck and the bore of the guide finished, great

* *Continued from page* 583, "*M.E.*," *May* 8, 1947.

care being taken to ensure that the bore was parallel. This operation being completed, the guide was removed from the chuck, and a mandrel made in its place; the mandrel was turned practically parallel but a good fit in the bore of the guide.

The guide and valve-seat were now forced on the mandrel, using the tailstock spindle to force it on, and the whole of the external part of the guide turned, including the threaded part, A, Fig. 31, which is screwed 36 threads per inch. The purpose of this will be referred to later on. The spigot on the opposite side of the valve-seating was now turned to be a good fit in 2, Fig. 29. The top side of the valve-seating was again trued up, and finally the outside diameter was turned to finished size. The holes in the valve-seating were marked off and drilled; they were six in number and 7/32 in. diameter.

This brings us to the purpose of the screwed portion of guide. A brass washer $\frac{1}{8}$ in. thick was bored and screwed to be a snug fit on the guide, and around this washer at the same pitch-circle diameter, and the same pitch as the holes in valve seating, six No. 1 B.A. tapping-holes were drilled, and in each of these holes was screwed, also a snug fit, a short brass screw having a conical recess in the bottom end (see 10, Fig. 29). These screws were fitted in order to limit the lift of the head-valves, which are stainless steel balls, and so prevent them leaving their place of duty. The external diameter of the washer was kept as small as possible in order to prevent it interfering with the free flow of the water when the pump is at work. Fig. 31 shows the detail.

The next part of the pump to be tackled was the foot-valve, which is a comparatively simple affair; a piece of $\frac{1}{8}$ in. thick brass plate trued up on each side, with 12 holes drilled in it to form the passages for the water, and a central hole to take the stud which holds the valve and its guard. In this case, the valve is a piece of rubber $\frac{1}{8}$ in. thick, with a central hole in it to fit over the collar of the stud, A, Fig. 32. The thickness of the collar, A, should be the tiniest bit less than the thickness of the rubber. What is a tiniest bit? Well just sufficient for the valve-guard, 11, Fig. 29, to clamp the rubber in its place; 0.004 in. would be ample.

The valve-guard is a piece of brass $\frac{1}{16}$ in. thick dished over a hole to the shape shown at 11, Fig. 29. The hole in the centre of the valve-guard is a fit on the screwed portion of stud, A, and is held in position by the nut and washer as shown in Fig. 29. One thing about this guard is important; a series of holes should be drilled through it; their positions do not much matter except for the sake of appearance. The idea of these holes is to prevent the rubber sticking to the guard under working conditions; the rubber should joint on the valve-seating and not on the guard.

We will now consider the piston, or bucket, as it is usually known. Figs. 29 and 30 are intended to show the details of this part of the job, which, by the way is the most important fitting of all; for, if the bucket is not a good job, the hope of a vacuum being obtained in the condenser would be futile. The first operation was to make the trunk 9, Fig. 29 and, A, Fig. 30. In addition to being the guide for the bucket, it holds the gudgeon-pin for the eccentric-rod which gives the bucket its motion. The position for this pin is as near the centre in every direction of the bucket as possible; this position prevents any possibility of the bucket oscillating during its upward or downward movement; also, the longer the eccentric-rod, measured from the centre of the crankshaft, the less tendency is there for the rod to bend, or the bucket to rock.

The bore of the trunk is not very important as regards being absolutely parallel. A piece of hard gunmetal was held in the chuck, with sufficient overhang to make the complete trunk; a small drill, i.e. a drill smaller than the diameter of the internally-screwed portion, was then put through the blank. A boring-tool small enough to pass through this hole was then mounted in the slide-rest, and the hole bored to the correct size for screw-cutting, after which the cut was increased and the body of the trunk bored larger,

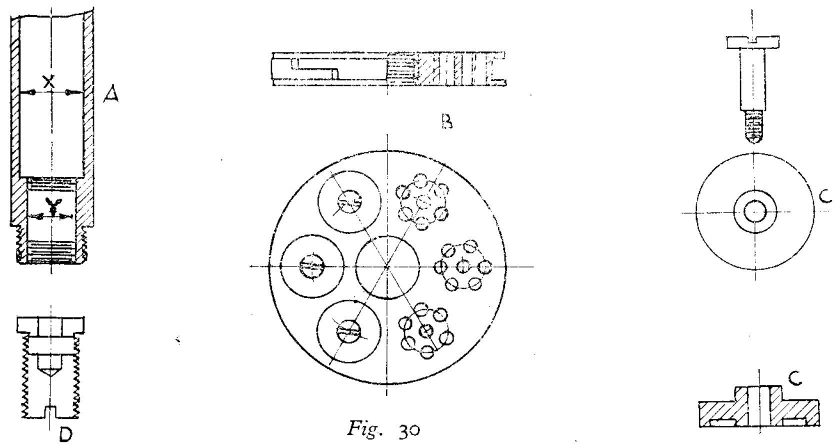


Fig. 30

care being taken not to run the tool back far enough, when coming back for the next cut, to destroy the size of the part bored for screwing. By means of the micrometer collar on the transverse screw of the slide-rest, it can easily be assured that the bore of the trunk is not too great; in other words, be sure that when boring, the tool is not withdrawn far enough to cut the job off.

Reference to X, Fig. 30, will make it clear

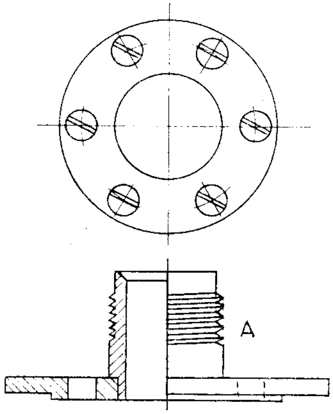


Fig. 31

that we are boring to get diameter X whilst retaining diameter Y. The bore Y is now screwed 36 threads per inch × $\frac{3}{8}$ in. diameter. The external diameter of A is now finished so that it is a fit in the bore of the guide, Fig. 31. This must be a good fit, otherwise the advantage of the guide is partly lost.

The end of the trunk is now reduced in diameter for a distance equal to the thickness of the piston or bucket, the reduction being sufficient to leave a shoulder for the piston to screw up against when assembling. This joint has also to be a good fit. The thread is then cut, and the trunk can be parted-off from the bar from which it was turned. This method may appear to be somewhat complicated, but it ensures accuracy.

The bucket was the next portion to be made, here again great care is necessary and with this knowledge the following was the method employed. A friend during the course of his travels came across what I believe was a portion of a very old carburettor, and thought it might be of some use to me. After the dirt had been removed, a piece of good-quality gunmetal was discovered; with a hacksaw, a piece sufficiently large for the purpose required was obtained, and more sawing and filing reduced it sufficiently to be put in the chuck, and roughed out to shape.

A hole was drilled, bored and screw-cut a good fit for the reduced end of the trunk, which was then removed from the lathe, and a suitable screwed mandrel made on which the piece could be held in the chuck, turned all over, and finished to a piston-fit in the bore of piece 2, Fig. 29. The groove for the piston-ring was then turned, and the pitch-circle for the holes for the valves and their spindles marked-off (see B, Fig. 30). The holes were marked off, and carefully drilled and, where necessary, tapped. The piston was then screwed on the trunk, and tested in the lathe; the result left nothing to be desired as far as accuracy was concerned.

The valves were next made, they are on the lines of the Kinghorne valves which are used in modern practice, but not true Kinghorne pattern. C, Fig. 30, will explain their shape; as will be noted, they are relieved on their working face just sufficiently to clear the holes in bucket. The same figure (C) shows one of the guides on which the valves work. Each valve was separately ground whilst on its guide, in the position which it would finally occupy; fine carborundum paste was used at first, then a second grinding using "Brasso." When a satisfactory bearing was obtained, they were assembled, on their guide pins with a very fine spiral spring of hard brass wire behind them, as seen in Fig. 29. In order to obtain wire fine enough for this purpose, the barrel of a Yale lock was wrecked, these springs will be found behind the small plungers in the barrel of the lock.

The portion D, Fig. 30, was next made; this is nothing more than a brass plug, with a collar on it, which latter is the same diameter as the larger part of the bore in A, Fig. 30, and screw-cut a good fit in the part Y. When screwed into its position the under-side of the collar makes a good joint at the bottom of bore, X, A, Fig. 30. A slot is milled across the centre of the plug wide enough to take the small end of the eccentric-rod, and a hole drilled through at right-angles to the slot to accommodate the eccentric-rod gudgeon-pin.

The piston ring was the next component required, and nothing was available from which to turn it, so other methods had to be employed. Once again the old carburettor provided the

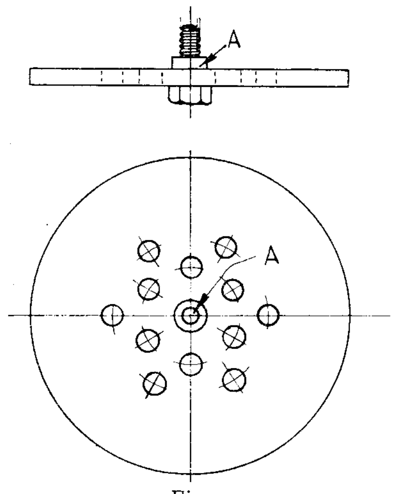


Fig. 32

solution; the float-chamber was amputated from the relics of the body and the bottom cut off. The tubular piece now remaining was split down one side, and then straightened out; this provided a piece of gunmetal longer than the circumference of the required ring. A strip

twice as wide as the finished ring was cut and filed flat on one side, and parallel on the edges. A little mensuration was then resorted to, and the length of the circumference of the bore of pump-body was calculated. This figure was the length of material required in the finished ring. Added to this was $\frac{1}{8}$ in. to allow for turning, and $\frac{3}{8}$ in. the amount of overlap at the joint. Reference to A, Fig. 33, will explain this; the pieces marked thus at each end of A were then sawn out, and the ends filed up.

This piece of metal, twice the width of the finished ring, and the correct length, with the ends stepped to form the joint in the ring was now carefully bent round to circular form, taking care to bend the extreme ends to the correct radius first. The stepped ends, having been previously tinned, were now sweated together, and the ring, after a few touches with the hammer to round it up correctly, was now sweated on to a piece of sheet brass. This assembly was then bolted on to the face-plate with the ring running true, and turned up to the correct diameter to fit the barrel of the pump. The ring was parted off, taking care in this operation to see that the horizontal part of the joint was in the centre of width of the ring. The joint was now unsweated, the tin cleaned off with a fine file, and the ring was complete.

It should have been stated that the ring should be turned a good fit in the body of the pump, and no allowance made for cutting the joint, and a further turning. B, C and D, Fig. 33, show the job mounted in the lathe.

The top cover of the pump was next made, the same care being exercised in the construction of this as was done in the making of the head-valve seat and guide; the bore of the stuffing-box must be absolutely concentric with the spigot on the cover, and the spigot a good fit in the bore of 1, Fig. 29. The cover was made in two pieces, i.e., the stuffing-box, and cover proper; they were shrunk together, bored, mounted on a mandrel and finished off. The top of the guide on the head-valve seat spigots into the under-side of the cover stuffing-box, and this spigot must be a good fit.

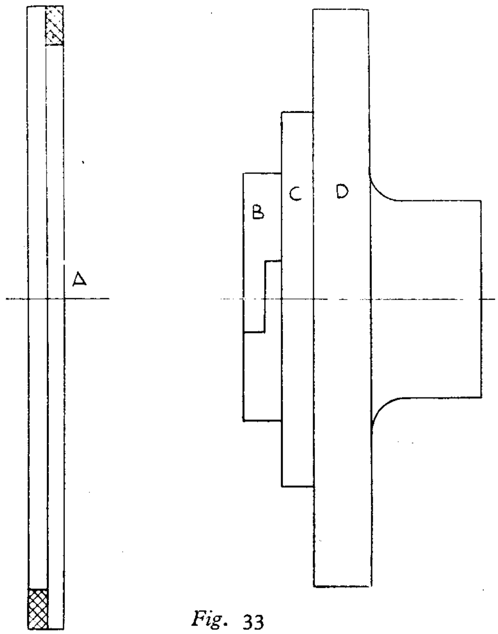


Fig. 33

The suction and discharge branches were then made, and soft-soldered into the sides of 1 and 3, Fig. 29. They were soft-soldered because it was not considered wise to risk heating the parts 1 and 3 to the temperature required for silver-soldering, and as no pressure was involved other than that of the atmosphere, soft-solder was good enough. The flanges, however, were made separately and silver-soldered to the short pipes forming the branches. The gland for the cover stuffing-box was made from two pieces shrunk together, and then machined to fit.

This completes the construction of the pump, except for marking-off and drilling bolt holes for jointing the various sections. There are eight 4-BA bolts in each joint and four 3/32 in. studs for tightening the gland in the cover. It should have been mentioned that at the bottom of the chamber, 3, Fig. 29, is a plain disc silver-soldered in position.

No description of the eccentric-rod and strap are necessary, as they are straightforward jobs. It might also be noted that the vertical clearances between piston, head, and foot-valves when working have been kept down to an absolute minimum. The pump has been tested on the condenser which was blanked off, and a vacuum of between 27 and 28 inches maintained for about an hour, the engine having been driven by a belt. What the results under working conditions will be, are still a secret, the answer to which is anxiously awaited by the writer.

(*To be continued*)

BOURNVILLE MODEL YACHT AND POWER BOAT CLUB

OUR Whitsuntide Open Regatta will be held on May 26th, at 2.30 p.m., at The Valley Pool, Bournville.

Race for 30-c.c. hydroplanes for the Coronation Speed Trophy, 1st, 2nd and 3rd prizes. Race for 15-c.c. boats, 1st, 2nd and 3rd prizes.

Steering competition for the A. Hackett Steering Trophy, 1st, 2nd and 3rd prizes.

Light refreshments available, but some notice of requirements and entries would be much appreciated by the Hon. Secretary: A. H. Harlow, 88, Langleys Road, Selly Oak, B'ham, 29.